Skyscapes

The Role and Importance of the Sky in Archaeology

Edited by

Fabio Silva and Nicholas Campion

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Front cover: Vincent Van Gogh's *Starry Night*, 1889. Museum of Modern Art, New York, USA/ Bridgeman Images
Back cover: The huaca of Moray, Peru (photo by Tore Lomsdalen).

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LIST OF CONTRIBUTORS

Bernadette Brady
b.brady@tsd.ac.uk
Sophia Centre for the Study of Cosmology in Culture,
School of Archaeology, History and Anthropology – University of Wales Trinity Saint David, UK

Daniel Brown
daniel.brown02@ntu.ac.uk
Physics and Mathematical Science,
School of Science and Technology – Nottingham Trent University, UK

Nicholas Campion
n.campion@tsd.ac.uk
Sophia Centre for the Study of Cosmology in Culture,
School of Archaeology, History and Anthropology – University of Wales Trinity Saint David, UK

Timothy Darvill
t.darvill@bournemouth.ac.uk
Department of Archaeology and Anthropology,
Faculty of Science and Technology – Bournemouth University, UK

Liz Henty
lizhenty@f2s.com
Sophia Centre for the Study of Cosmology in Culture,
School of Archaeology, History and Anthropology – University of Wales Trinity Saint David, UK

Tore Lomsdalen
tore.lomsdalen@gmail.com
Independent scholar

J. McKim Malville
kimmalville@hotmail.com
Astrophysical and Planetary Sciences – University of Colorado Boulder, USA

Frank Prendergast
frank.prendergast@dit.ie
College of Engineering & Built Environment – Dublin Institute of Technology, Ireland

Olwyn Pritchard
29000610@student.tsd.ac.uk
School of Archaeology, History and Anthropology – University of Wales Trinity Saint David, UK

Fabio Silva
fabio.silva@ucl.ac.uk
Sophia Centre for the Study of Cosmology in Culture,
School of Archaeology, History and Anthropology – University of Wales Trinity Saint David, UK
and Institute of Archaeology – University College London, UK

Lionel Sims
lionel.sims@btinternet.com
School of Law and Social Sciences – University of East London, UK

PREFACE
Meaning and Intent in Ancient Skyscapes – An Andean Perspective

J. McKim Malville

The Search for Meaning

The papers in this volume deal mostly with prehistoric archaeoastronomy in the Old World, for which there is little or no ethnographic or ethnohistoric material that can assist in the interpretation of findings. This lack was initially contrasted with the situation in Mesoamerica for which there was rich ethnographic information and led to the distinction between Old World and New World archaeoastronomy, initially codified by Aveni (1989) as "green" (European) versus "brown" (American) archaeoastronomy.

That distinction is less cogent today, as archaeoastronomy in the Americas has expanded into areas and time slots where there is also a lack of ethnographic material, such as Cahokia (Illinois), Chaco Canyon (New Mexico), and Peru. For example, the archaeologist Steve Lekson (2008) has vigorously argued that the Chaco Canyon culture was an unsuccessful experiment, which was abandoned by the ancestors of today's Puebloan peoples, and therefore one cannot use Puebloan ethnography to understand the nature of Chacoan culture. In the case of Peru, millennia of pre-Inca Andean culture lie far beyond the reach of the Spanish Chroniclers and their writings. The ethnographic record is similarly mute and one must rely upon thorough investigations of the archaeological record to probe cultural context and meaning.

An ever-present question in cultural astronomy and archaeoastronomy is why were events in the heavens so powerful and meaningful to ancient cultures that they caused the investment of energy and wealth in the construction of stone structures aligned to astronomical phenomena. The ethnographic approach known as "thick descriptions of human behavior", championed by the anthropologist Clifford Geertz (1973, 1983), can help us in our search for meaning contained in ancient skyscapes. Thick description emphasizes the emic (as opposed to etic) significance of social action and seeks an explanation. Applied to archaeoastronomy, thick descriptions should lead to using astronomical markers as signifiers of processes and meaning within that culture. As Geertz (1983, 58) comments, "The trick is to figure out what the devil they think they are up to". Thick description "is clearly a task, at least as delicate, if a bit less magical, as putting oneself into some else's skin". Geertz's (1983, 50).

To reach an understanding of those cultural processes that manifest as astronomical alignments, we need a multi-disciplinary approach. Limiting ourselves only to astronomy will never fully reveal the cultural complexity of a site. Not only must we work with our archaeologist colleagues, but we need to collaborate, when possible, with cultural anthropologists, linguists, ethno-historians, and even paleo-hydrologists. Furthermore, archaeoastronomers need to investigate multiple aspects of the archaeological record, even if they do not contain obvious astronomical elements. In his introduction to the proceedings of the Oxford IX conference in Lima (Peru), Ruggles (2011, 7) alludes to this kind of a holistic research programme: "... the archaeoastronomer not only has to focus on broader cultural questions but also has to have sufficient genuine interest in these broader questions not to become demotivated if the data start to produce non-astronomical answers". In a recent paper Silva has mirrored this by arguing for a stronger archaeological and cultural contextualization of archaeoastronomical work, something he called "skyscape archaeology" (2014, 25).

Different Ontologies

Meaning and intent embedded in ancient skyscapes may reveal a totally different understanding of reality, a different ontology. The so-called ontological turn in anthropology can provide new tools in our search for meaning (Henare *et al.* 2007). It involves a movement away from the assumption that there is one world, but many worldviews, to multiple worlds that are fundamentally different from each other. Such a program should not be shocking to astronomers and physicists, who regularly deal with phenomena in quantum mechanics that are absolutely impossible to understand on the basis of our everyday reality (Barad 2007; Pickering 1984). Quarks, time dilation, strings, curved space-time, and black holes lead to universes that are often shockingly different from our everyday world. Unless physicists had been willing to abandon classical physics, we would today face a huge collection of totally unexplainable phenomena.

The remainder of this preface will illustrate how an understanding of a different ontology, such as the Andean concept of a *huaca*, can help assess and feed into the interpretation of the archaeological record and the ancient skyscapes of prehistoric Peru. It is to be hoped that this approach can be similarly useful in the interpretation of the prehistoric skyscapes in the Old World.

Andean Huacas

The sculptural modifications of natural rocks in the Andean world, known as *huacas*, appear to demonstrate the presence of a different ontology (Fig. 0.1). According to our understanding of huacas, coming from the ethnohistoric record, these are objects that blur the distinction between animate and inanimate, people and things, living and non-living (Bray 2009, 2014). Huacas were thought to speak, hear, and communicate, both among themselves and with humans. They possessed extraordinary powers to effect change and provide advice as oracles. In their capacity as nonhuman persons, they were clothed and fed, consulted for advice, fought over, and kidnapped by enemies. Young women were married to stone huacas, who then had sons and daughters.

Fig. 0.1: The carved Huaca of Piedra Cansada near Cusco.

Most of the huacas were associated with flowing water, which played a role in bringing them to life through the process known as *camay* (Bray 2009; Salomon and Urioste 1991; Malville 2009). Camay was a profoundly biological metaphor, in which moving water brought life out of inanimate matter embedded in the earth, such as a seed. The hydrological cycle, as envisioned by Andean myth, started from snow, glaciers, rain, and mist. Water moved across the earth into the ocean, where it was carried aloft by the celestial llama constellation and returned to the land. For agricultural communities the sun would have been recognized as an equally necessary agent of animation. While this process is distinctly an Andean myth, it is not unreasonable that agricultural communities around the world would have imagined that the combination of flowing water, earth, and sun resulted in the animation of previously inert matter.

The Torreon of Machu Picchu

One of the major huacas of Machu Picchu is the large rock, the top of which is surrounded by the curved wall of the Torreon (Fig. 0.2). The lower portion of the rock contains the sculptured cave, named the Royal Mausoleum by Hiram Bingham. The major water channel in Machu Picchu makes a significant detour toward the vicinity of the Torreon. The nature of the detour suggests intention to animate the huaca, through *camay* (Malville 2014a; Ziegler and Malville 2013). The cave is illuminated at June solstice by the light of the rising sun,

and within it there are niches for mummies, carved non-functional steps symbolic of ascent across the worlds of the cosmos, and elegant stonework. A window of the Torreon allows the sun at June solstice to illuminate the top of the rock, which contains a shaped edge, which is oriented to the sun on that day. Dearborn and White (1982) established that the shaped edge lies within two arc-minutes of the rising position of the sun on June solstice and speculated that the shadow of a string holding a plumb bob suspended in the window would have provided a device for determining the date of June solstice. The shape of the rock and the location of the window does not allow a direct sighting outward of the sun. The use of plumb bob to establish solstice would have been unique in Inca culture. Furthermore, it would have been unnecessary because the serrated north-eastern horizon provides satisfactory markers of the position of June solstice sunrise. An interpretation more in keeping with Andean traditions is that the north-eastern window of the Torreon was not designed for an astronomer-priest to look out, but for the sun to look inward, touch, and animate the rock.

What does it mean? The rock, illuminated by the sun on top with a cave is similar to Machu Picchu's dominating peak of Huayna Picchu. Both appear to represent a cosmic mountain, axis mundi, and movement across the worlds.

Sun Doors

Near the Torreon there are two double-jamb doorways. One establishes entry into a sacred area, but the other does not fit the accepted interpretations of such doorways. Double-jamb doorways, i.e. doors within doors, had a special importance in the Inca world. They established sacred and restricted areas into which only certain elites could enter. Machu Picchu contains 11 such doorways: four are associated with elite residential areas and six provide entry to restricted sacred areas. A double-jamb doorway some 80 m north of the principal entrance provides an intriguing puzzle. Instead of controlling entry into a restricted space, it faces away from the entrance, toward June solstice sunrise, toward an azimuth of approximately 63.5º, similar to the orientation of the double-jamb doorway of Llactapata, five kilometres to the west of Machu Picchu. The Corichancha of Cusco, also faces June solstice with a similar orientation (Fig. 0.3). A stone lined channel leads from the door of Llactapata toward the sacred plaza of Machu Picchu. Behind that doorway is neither spring nor sacred area, just the hillside. All three double-jamb doorways appear to be structures for the sun to enter, perhaps to illuminate and animate objects that once lay beyond.

Moray

The great sculptured pits of Moray were once interpreted as agricultural research stations built by the Inca to adapt plants to the harsh conditions of the altiplano (Fig. 0.4). The possible differences in temperature and humidity at different levels were thought to correspond to different growing conditions. As an agricultural station, it would have been unique in the Inca world. Recent studies on Moray by the Wright Paleohydrological Institute (Wright *et al.* 2011) have provided definitive evidence that the basins could not have functioned as an agricultural research station. Due to evaporative cooling on all terraces, there is no significant temperature differences between terraces during the rainy seasons or when it

was irrigated. Furthermore, water channels were designed to feed water to drop structures only near the southern end of the basins, and water would have had to flow uphill to reach the northern portions of the terraces.

The precise and elegant terracing of these natural pits suggest they were much more than a research station, but that they were huacas, animated by the act of shaping, flowing water, and illumination by sunlight. Instead of carving a rock that thrust itself into the sky, these basins were carved into the earth. In addition to being huacas, the basins may have functioned as immense *ushnus* which, in some cases, were holes in the ground into which offerings to Pachamama were poured (Staller 2008). Ceremonies intended to encourage rainfall and bountiful harvests, may have taken place when falling rain or water released from its reservoirs flowed downward into the basins. Stairs symmetrically placed about the water channels provided the means for ritual movement downward and upward. A dramatic public ceremony may also have occurred on the days of the zenith sun, when terraces would cast no shadows, and light of the sun would pass directly into the earth. A resident of the nearby town of Misminay reported the belief that during Inca times the pits were lined with gold and silver plates, which, if true, would have brought the great pits alive with light.

Intent and Intentionality in Prehistoric Peru

The absence of ethnohistory of prehistoric sites does not preclude learning something about intent. Repetition, patterns in the landscape, and redundancies can provide hints of continuities within the culture. Architectural symmetries can be powerful statements about the intent of the builders. Perhaps there has been too much concern for statistical testing of intentionality of astronomical features of prehistoric sites for which there is no ethnohistory (see Silva 2014 for a similar argument in European prehistoric archaeoastronomy). The intent of the people should be more interesting than tests for intentionality of a particular astronomical orientation.

The Casma Valley in Northern Peru was the scene of extensive construction of ceremonial centers with ascending platforms, plazas, and U-shaped structures oriented to the solstices (Pozorski 1987, 2002, 2012). Sechin Alto, contains the largest artificial mound in the Americas with a monumental stairway oriented to June solstice sunrise. Of the thirteen major sites in the valley ten have orientations to the solstice sunrises (four to December and six to June solstice). The most prominent symbolism of these temples is that of ascent upward, movement from earth (or underworld) to the heavens.

One of the most extensively investigated sites is Chankillo, with a fortress, thirteen towers with their stairways, and major alignments to December solstice sunrise by U-shaped ceremonial building and walls. In addition to the possibility of ritual performances in its three plazas at June solstice sunset, the thirteen towers may have served as successively higher platforms, similar to most of the other temples of the Casma Valley. These platforms have stairs on both sides, except for the highest which has a stairway only on its north side, indicating that it was the final destination for upward ritual movement. Ghezzi and Ruggles (2007, 2011) have suggested that the thirteen towers functioned as a calendrical device, for which there is no precedent in the Casma Valley. The two locations where calendrical information could have been obtained are unremarkable and not in the major plazas of

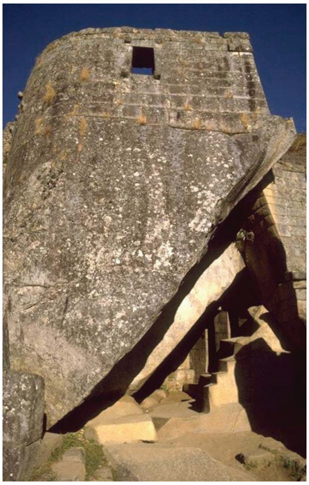

Fig. 0.2: (left) The torreon of Machu Picchu at June Solstice (photo courtesy of Clive Ruggles).

Fig. 0.3: Sun Doors: double-jamb doorways at Llactapata (left) and Machu Picchu (right).

Fig. 0.4: The huaca of Moray (photo courtesy of Tore Lomsdalen).

Chankillo. Based upon our understanding of the continuity within the culture of the Casma Valley, that hypothesis must be considered suspect (Malville 2011, Malville 2014b).

It is worth noting that the Spanish Chroniclers did not know about the platforms and mounds of the Casma Valley. They were clearly unaware of Machu Picchu, which was not

Fig. 0.5: The towers of Chankillo.

rediscovered until 1911 by Hiram Bingham. Llactapata was also unknown to the Spanish, rediscovered only in 2003 (Malville *et al*. 2006). Likewise, the great basins of Moray were unknown to the Spanish and were first photographed by Shipee and Johnson in 1932 (Wright *et al*. 2011). Only extensive measurements of temperature, hydrology, and astronomy at Moray have made it possible to develop and test interpretative hypotheses. Considering the vast span of time included in the Andean culture area, most of the archaeological record of Peru is lacking in ethnographic or ethnohistoric documentation. Yet, the techniques of "skyscape archaeology" (Silva 2014; Henty 2014) utilizing strong archaeological contextualization combined with Geertzian thick descriptions have made it possible to develop hypotheses about meaning and intent in these cultures.

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1

The Role and Importance of the Sky in Archaeology: An Introduction

Fabio Silva

> "**sky·scape** *noun* \ˈskīˌskāp\
>
> 1 : a part of the sky with outlined terrestrial objects that can be comprehended in a single view […]
>
> 2 : a picture that includes an extensive view of the sky"
> (MWD 2004)

The Merriam-Webster dictionary definition above stems from the art world, where skyscape paintings such as "Starry Night" by Vincent van Gogh (Fig. 1.1) have become famous. Van

Fig. 1.1: Vincent van Gogh, Starry Night*, 1889, oil on canvas, Museum of Modern Art., New York, USA/Bridgeman Images.*

Gogh's oil painting shows a distant mountainous landscape, a small town nearby with a cypress tree partially restricting the view towards the left. Above, a crescent moon and several other lights, depicting stars, illuminate the setting and are disturbed only by a whirlwind of cloud in the centre of the canvas.

Van Gogh's skyscape is as realistic as it is filtered by the perceptual lens of the artist: "The mountains in the Starry Night are the same Alpilles that Van Gogh could see from his cell window […]. From that base in observed reality, Van Gogh's imagination took hold. But it was fed by sources in both nature and art" (Soth 1986, 303). Several scholars have tried to identify the depicted constellation, with both Aries and Cygnus being likely, but not certain, candidates (Boime 1984; Whitney 1986). Soth, on the other hand, believes that the depicted stars are not realistic but instead that their meaning should be sought in the conceptual and circumstantial history of the painting. She concluded that Van Gogh unconsciously merged his desire to both paint a skyscape as an image of consolation, and paint the biblical episode of the consolation of Gethsemane, into his 1889 painting. "Unable to paint *The Agony in the Garden*, Van Gogh projected its emotional content onto nature and created a sublimated image of his deepest religious feelings. […] The blue for Christ and the citron-yellow for the angel became the sky, and the stars and moon." (Soth 1986, 312). As Soth put it, "At its most profound level, the *Starry Night* is Van Gogh's *Agony*." (1986, 312).

This skyscape painted by Van Gogh is no different from those painted, sometimes metaphorically and other times quite literally, by other cultures, both past and present. Different cultures might have "access" to the same sky but "see" completely different skyscapes. As an example, astronomers have grouped the visible stars into readily identifiable shapes that are known as constellations. The modern western constellations are based on those catalogued by Ptolemy in the 2nd century CE (Ptolemy, 1998), though some might be even older (e.g. Frank and Bengoa 2001). However, other cultures group the stars differently: for instance where we see a large bear, a big dipper, or Charles' wain (the constellation *Ursa Major*), the Inuit of Igloolik (Canada) see a caribou (Macdonald 1998, 79). Others, like most contemporary hunter-gatherer groups, name individual stars but tend not to group them in constellations (Hayden and Villeneuve 2011, 340–344), whereas Quechua speakers of the central Andes see constellations in the "dark clouds" of the Milky Way (Urton 1981). Ruggles and Saunders proposed three key processes in the formation of a skyscape: observation, perception and use (Ruggles and Saunders 1993, 2–4). Observation denotes the ability to notice the sky and its components, either casually or deliberately. Perception involves "making sense of and attaching meaning to particular observations" (1993, 2), whereas use refers to the employment of celestial phenomena for any social, economic, political or ideological purpose. Mirroring Cummings' words for the landscape (2001, 82), one can say the sky is a natural phenomenon that is turned into a cultural skyscape through human agency.

The study of the relationship between the sky and human societies has become the purview of Cultural Astronomy. Under this umbrella term fall the study of the history of astronomy and astrology, ethnoastronomy and archaeoastronomy, each with its own methodologies and primary sources. Archaeoastronomy is the key concern of this volume although from time to time, authors leap into history and ethnoastronomy and back again. Archaeoastronomy is the study of how people have understood, conceptualized and used the phenomena in the sky and what role the sky played in their cultures, by analysing their material remains. It inhabits that interdisciplinary "no man's land" between astronomy and

archaeology, and therefore draws on established knowledge and techniques from both fields. It has a considerably younger history than its two big sisters, but in the past few decades it has found its feet by becoming deeply rooted in fieldwork and statistical tests for validity (e.g. Ruggles 1999). Archaeoastronomy has become an academic discipline, with its own conferences and journals, but in the process of (re)defining itself to withstand scientific scrutiny it lost its links to the wider archaeological and anthropological communities. The reasons for this are now historical but the consequences are clear: the different approaches are not being integrated into holistic interpretations of the archaeological record.

Why then use a new term – skyscape – to talk about the use of the sky in culture?[1] The sky has been neglected within the archaeological world, but ethnography and archaeoastronomy tell us of its importance and role for most, if not all, cultures (Campion 2012). In using a new word old assumptions are not carried over so easily, and new connections can be crafted. There are precedents for using new terms to re-think old notions in the establishment of concepts such as landscape, taskscape and seascape in archaeology. The study of the landscape is now well established in archaeology (e.g. Tilley 1994; Cummings 2001). Seascapes and waterscapes extend these approaches into the seas and rivers (e.g. Wehlin 2010), whereas taskscapes look at the executed tasks and the 'temporality of the landscape' (Ingold 1993). Skyscapes extend this upwards to encompass the heavens and the celestial bodies and how they relate back down to human beliefs and practices, to their notions of time and place, to their structures and material remains. The thread that unites all of these "–scape concepts" is that they refer to an ensemble of interlocked components, each taking "its meaning from its position within" the ensemble (Ingold 1993, 158). The latter, referring back to the dictionary definition of skyscape, "can be comprehended in a single view". The disciplines that study these "–scapes" share "a theoretical concern with how people constructed and used the environments around them" (Ruggles 2011, 7), as well as a variety of unique field techniques and methods that range from the quantitative to the phenomenological. They are sister disciplines: archaeoastronomy looks up, whereas landscape archaeology and the others look down and around, although they always meet at the horizon.

The case studies in this volume illustrate several of the characteristics of a skyscape that mirrors those used to describe landscapes. Keeping to Cummings' extensive list of landscape traits (2001, 75–80) it will be shown that: the skyscape "plays an active role, structuring and structured by human agency" (chapters 3, 4, 6, 10); myths may shape and be shaped by the sky (chapters 7 and 10); the skyscape "is an ideal canvas for the application of metaphors" (chapter 7); people's "ideologies form and are formed by" the skyscape (chapters 5, 7 and 10); like landscapes, skyscapes "are open to control and thus become tied to political strategy and structures of inequality" (chapter 5); and that the skyscape "structures time and time structures the way we experience" it (chapters 7, 8 and 10). The similarities are not merely academic as several cultures do conceptualize the sky as a landscape, or see the two as equivalent on different levels, sometimes forming a holistic representation of the cosmos (e.g. Urton 1981, 63). In this way, the horizon also gains a new standing: that of mediator between the landscape and the skyscape, between the earth and the sky. It is thus no wonder that sun, moon and star-rises and -sets are the most widespread celestial phenomena encoded in alignments of structures. An understanding of the dynamics of rises and sets, informally known as 'horizon astronomy', is one the most important tools of an archaeaostronomer.

This volume is based on a half-day session organized by the editors at the 2012 meeting of the Theoretical Archaeology Group (TAG), which took place at the University of Liverpool. That session's title is now the title of this introduction. The aim of that session, as set out in the proposal to the organizers, was to "extend the discussion of the role and importance of the wider environment into consideration of the significance of the celestial environment – the 'skyscape', to past societies and to the understanding and interpretation of their material remains". This volume strives to achieve that same aim. It shows how it is not only possible but even desirable to look at the skyscape to shed further light on human societies. This is done by first exploring the historical relationship between archaeoastronomy and academia in general, and with archaeology in particular. The volume continues by presenting case-studies that either demonstrate how archaeoastronomical methodologies can add to our current understanding of past societies, their structures and beliefs, or how integrated approaches can raise new questions and even revolutionise current views of the past.

Following this introductory chapter, Nicholas Campion looks at the history of archaeoastronomy, particularly by tracing the key scholars on both sides of the archaeology/ archaeoastronomy divide, as well as the evolution of archaeoastronomical methodologies. The contested nature of prehistory is seen to have been paramount in the relationship between the two disciplines but, more recently, the two have begun to converge in their multi-disciplinarity.

Chapter 3 continues to explore the rapport between archaeology and archaeoastronomy but narrows its focus down to the study of the Recumbent Stone Circles of northeast Scotland. Liz Henty explores the history of work done on these four thousand year-old monuments, as well as her own fieldwork, to highlight the many differences between the disciplines that have rendered their interpretations incomplete. By contrast, Henty suggests that 'the prehistoric sky is as much an artefact to be examined as a polished stone axe' and that the combination of methodologies stemming from the two fields provide fuller explanations.

Today few people know what phase the moon is on any given day, or how high above the horizon the sun is going to be at a given season. The modern world has disengaged with the sky, partially due to its obfuscation by the aptly named skyscrapers and the light pollution stemming from the urban centres. This is one of the reasons why academia has sidelined archaeoastronomy, because the modern skyscape itself is neglected and misunderstood. Daniel Brown, in chapter 4, explores the challenge of overcoming the modern period's disengagement with the sky, through the current topics of sustainability and light pollution. "Dark Skies" projects extricate people from the ever-present urban glow into areas, such as the Peak District national park, which have preserved the integrity of their skies. Such experiences demonstrate that the movements of sky, although presently the domain of astronomy and physics, are perceived by everyone without the need to recur to equations and other modern contrivances. This presents unique opportunities to understand how individuals negotiate meaning and embrace the experience of place, which will 'allow one to judge the impact a skyscape would have had in ancient times'.

In chapter 5 Lionel Sims takes a multi-disciplinary look at some peculiar features of the Avebury complex (Wiltshire, England). The author shows how the traditional archaeological narratives leave much of the material evidence surrounding the West Kennet Avenue unexplained. These, he argues, can be understood with recourse to cultural astronomy, "an

additional tool to recover the ancient past". Sims notes the careful placing of the avenue's stones so that celestial alignments to the sun and/or moon are visible when looking from behind one stone to another. In addition, the evidence surrounding stone pair 30, like the absence of a stone 30b, might be explained by a materialization of the lunar phase cycle of 29.5 days. Using the hypothetico-deductive method, and anthropological models for the Neolithic transition, Sims suggests a model for "male cattle-herder monopolisation of lunar-solar ritual confiscating ancient egalitarian matrilineal lunar rituals" that demonstrates how the skyscapes can be appropriated by an elite for political uses.

Jumping to the middle of the Mediterranean, chapter 6 takes us to the Late Neolithic temples of the Maltese islands. These megalithic structures are unique in style and their purpose is as poorly understood as their origins. One of the last and most extraordinary complexes, that of Mnajdra on the island of Malta, consists of three temples of varying dimensions and style. The chronology of their construction has been gauged by ceramic shards found in several rooms of the temples, whose typology can only suggest a very rough sequence. To the typological evidence, Tore Lomsdalen adds his archaeoastronomical fieldwork and notes that the main temple's most spectacular feature – the illumination of key internal elements at sunrise throughout the year – has been encoded in the temple's earlier incarnations. As the temple was expanded so too did the astronomical alignments become more precise and sophisticated, mirroring the increase in architectural complexity. Based on the combination of typological and archaeoastronomical evidence, Lomsdalen proposes a well-defined building sequence for the monumental complex, illustrating how archaeoastronomy can be used for more than the identification of celestial alignments.

Egyptian religion's relationship with astronomy, in the four thousand or so years of its history, is well documented (e.g. Belmonte and Shaltout 2010). But the earliest known religious texts, carved on the inner walls of the pyramids of the Fifth Dynasty are poorly understood. In chapter 7 Bernadette Brady re-examines the Pyramid Texts in light of an understanding of the yearly cycle of the stars. These stellar dynamics were classified by Ptolemy in the first century CE, but present-day academia is yet to pay attention to this aspect of his work. To help deal with this oversight, Brady proposes a set of unambiguous terms which acknowledge and separate the star phases of Arising and Laying Hidden and Curtailed Passage. Armed with this knowledge, the religious content of the Pyramid Texts is seen to describe naked-eye astronomical phenomena. In this way, the very origins of some of Egypt's long-lasting religious concepts, such as the King's afterlife among the Imperishable Stars, can be seen to ultimately derive from an understanding of stellar astronomy. Furthermore this chapter, because it demystifies the stellar phases, is a major contribution for the understanding of how other past societies might have engaged with, and used, the yearly cycles of the stars.

Chapter 8 looks at the Iron Age enclosure of Lismullin, Co. Meath (Ireland). Frank Prendergast conducts a geospatial analysis of the site, including its archaeoastronomical properties. He argues that its "avenue may have been intentionally orientated so as to align upon the autumnal appearance of the Pleiades", which would have coincided with the end of harvest and the beginning of winter. This hypothesis is, as the author points out, one of many possibilities. To explore how the site could have been used as a structure for public gathering and ceremonies, Social Network Analysis is applied to the data. Prendergast concludes that the enclosure contains "the hallmarks of a temple site – large scale, formal entrance,

processional space, threshold, depositional space, viewing space, openness and planned orientation”. This chapter is one of the first published applications of this methodology to archaeology, a methodology that is becoming increasingly popular, as attested by the journal special issue by Evans and Felder (2014).

Olwyn Pritchard then takes us across the Irish Sea into Pembrokeshire (Wales). In Manorbier a unique dolmen, the King’s Quoit, rests on a slope that allows for an unobscured view toward the north. From this position two Early Bronze Age round mounds are seen on the horizon, lying almost exactly equidistantly from true north. To reconstruct the prehistoric skies, and assess their importance, one needs to have a date for the archaeological site. The King’s Quoit dolmen is not directly dated, however the author makes a case for an Early Bronze Age date, making it contemporaneous to the mounds seen on the horizon. During this period a particularly bright star, Deneb, would have been seen to set in the western mound and rise, four hours later, above the eastern mound. At the same time, the even brighter star Vega, would have grazed the horizon, never truly setting. If the positioning of the dolmen and mounds relative to these northern stars was intentional, it demonstrates that Bronze Age Britons were aware of the stellar phase of Curtailed Passage and certainly this would have been meaningful to them, just as it was for the Ancient Egyptians.

In the last case study, an approach that integrates landscape and skyscape archaeology is taken to re-assess the location and orientation of the dolmens of a particular river valley in the northwest of Iberia. Fabio Silva finds a pattern common to all known structures in this region that emphasizes the view from within the dolmens’ chamber. This pattern highlights the region of the horizon where Aldebaran, the brightest star of Taurus, would have been seen to rise, directly above a conspicuous mountain range. The heliacal rising of this star, at the end of April, could have been used as a seasonal, ceremonial and economical marker, as it is known that the dolmen builders would, at some point during the spring, move from the river valley into the very mountain range above which the star is seen to rise. This pattern raises new questions on the megalithism of north-west Iberia, particularly as to what relates to the dolmens’ meaning and purpose, which are explored in chapter 10.

Finally, in an afterword, Timothy Darvill reinforces and highlights the importance of the study of skyscapes to present-day archaeology. Key methodological issues that will have to be overcome in the future, and crucial research themes that will surely drive the archaeology of skyscapes for the next decades are identified. In particular, Darvill emphasises the position of the skyscapes in a society’s cosmology, the importance of pattern-recognition in the study of the relationship between skyscapes and monuments and issues of time-depth and continuity.

In deference to Lévi-Strauss, who said “animals were good to think” (Lévi-Strauss 1973, 162), these chapters illustrate that skyscapes too are “good to think” with. For Van Gogh, his “Starry Night” was an image of consolation, related to the biblical episode of the garden of Gethsemane. For past societies the sky was an important resource and an equally significant component of their world-views and social lives. For present-day scholars who try to shed light on the past, archaeoastronomy complements other approaches to the interpretation of the material record. This volume shows that more empirical and theoretical work stills needs to be done to deal with the interpretative subtleties of the integration of the disciplines, but it is no longer possible to neglect the role and importance that skyscapes have played in the social, economic, religious and political spheres of cultures around the world in the past.

Note

1 Although the term ‘skyscape’ was first, and seemingly only, used by Harding *et al.* (2006), its definition and implications were not explored by these authors.

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2

Skyscapes: Locating Archaeoastronomy within Academia

Nicholas Campion

The sky is all around us. We would not be alive without it, and yet it proves a most elusive target for academic research and the understanding of culture. The notion that the sky played an essential role in the formulation of ancient societies is widely assumed. For example, according to Peter Berger (1969, 34).

> Probably the most ancient form of legitimation is the conception of the institutional order as directly reflecting or manifesting the divine structure of the cosmos, that is, the conception of the relationship as one between microcosm and macrocosm. Everything 'here below' has its analogue 'up above'.

And again, a common view from amongst astronomers:

> … the sky played a key role in the whole system of ancient people's ideas of nature and society. … In ancient men's notions of celestial bodies and laws of their transit[s], links of their cosmic and terrestrial rythms [sic], positive knowledge and mythology are inseparable. Not a single ancient culture can be understood without studying all of these notions…(Raevsky 1998, 300).

Some such views draw on historical sources. For example, the 17th century Spanish Priest Bernabé Cobo is cited by David Dearborn:

> The movements of the heavenly bodies are an admirable thing, well known and manifest to all peoples. There are no people, no matter how barbaric and primitive, that do not raise up their eyes, take note, and observe with some care and admiration the continuous and uniform course of the heavenly bodies.[1]

My proposition is, simply, that landscapes do not exist without skyscapes. Barbara Bender (1998, 98) argued that 'people's experience of the land is based on their everyday attentiveness to the tasks in hand, the routines, their relations to each other, to their animals and crops, and to the world around them'. And, by world, we can read 'sky' in the fullest sense, with its attendant clouds, wind, rain, thunder, lightning, Sun, Moon and stars. From a phenomenological point of view this is difficult to challenge. After all, landscapes cannot be seen without the sky; without the light of the Sun which creates day and, at periodic intervals, the light of the full Moon which mitigates the darkness of night. Simply, landscapes do not exist without skyscapes. Neither does life: the sky is the source of warmth, the air which we breathe and, from rain, much of the water we drink. We might, then, argue on *a*

priori grounds that any study of ancient culture which does not include the sky is therefore capable of only ever providing a partial picture of ancient cultures. Just as land, though, does not exist without sky, so sky does not exist without the definition provided by land: simply, when the Sun is below the horizon, where land ends, the world is cold and dark and, when it is above, the world is warm, or, at least, warmer, and light.

Following this theme, Chris Tilley (1994, 26) wrote of cultures in which the experience of land is based on 'the physical and biological experience of landscape – earth, water, wood, stone, high places and low places, the wind, rain, sun, stars and sky'. For example, landscapes such as those of aboriginal Australia may be as much a physical representation of cosmology and mythology as they are of the tasks and routines of mundane existence (Tilley 1994, 47). Further, cultures which assume that ancestors and ancestral beings are associated with the land develop a profoundly personal relationship with it, and are required to care for it: thus land, sky and people exist in a system of integrated, inter-dependent and interlocking mutual relationships. Barbara Bender (1998, 6) followed W. G. Hoskins' (1985) view of landscape as a palimpsest upon which many different uses and experiences have been laid throughout history. Christopher Tilley then wrote of places as acquiring history over time, which then results in what he calls 'sedimented layers of meaning'; such layers of meaning are then recorded and revealed in the narratives people construct about their knowledge and experience of place (Tilley 1994, 32). Landscape then becomes not a matter of static geological form but is contested, social, active and created. Similarly, if the environment becomes, in John Evans' (2003, 14) words, a means of 'how people think, relate to each other, and understand their lives', then this is true of the celestial part of the environment as much as the terrestrial. And, if terrestrial 'Places, pathways and human subjectivities mediate each other to create an understanding of... social being' as Tilley (1999, 180) put it, then so, we can conclude, do celestial. Such notions of landscape may then be applied to the sky itself, which can be seen as a palimpsest containing sedimented layers of meaning, a cultural record of the past, an archaeological source if we care to use it. It is in this context that the School of Archaeology, History and Anthropology at the University of Wales Trinity Saint David is now, as from 2013, recognizing 'skyscapes' as part of trinity of 'scapes', the others being 'landscapes' and seascapes' in its teaching and research strategy.

The importance of the sky in culture has been taken up by the current wave of academic archaeoastronomers as the rationale for their discipline. For example, according to Clive Ruggles (2011, 6), 'It is evident, from any reasonable theoretical standpoint, that human perceptions and actions relating to the sky are intertwined with perceptions and actions relating to almost anything else'. Arguing that the sky should therefore be taken into account in any attempt to study culture, Ruggles (2011, 6) added:

> The sky is of universal importance. Cultural perceptions of the sky are vital in fulfilling humankind's most basic need to comprehend the universe it inhabits, both from a modern scientific perspective and from countless other cultural standpoints, extending right back into early prehistory. They form a fundamental sect of people's conceptions of their own cultural identity. Developing an understanding of these perceptions is a crucial component of Western anthropologists', archaeologists' and historians' efforts to comprehend human conceptions and actions both in the past and in the present.

The discipline which combines archaeology with astronomy is conventionally known as archaeoastronomy, the alternative, astroarchaeology, having a minority appeal (Ruggles

2011, 15). But, like all such terms, archaeoastronomy has no single, settled definition. A simple view occurs on the Sophia Centre website:

> Archaeoastronomy is the study of the incorporation of celestial orientation, alignments or symbolism in human monuments and architecture.[2]

However, the Sophia Centre module on Skyscapes is taught within the wider context of a MA which deals with a range of historical and anthropological issues. A wider definition is therefore also appropriate, as in Clive Ruggles' from 2009:

> Archaeoastronomy is the study of *beliefs* and *practices* relating to the sky in the past, especially in prehistory, and the *uses* to which people's knowledge of the skies was put (my emphasis).[3]

In this sense the identification of any astronomical components in ancient sites becomes only a means to building a fuller picture of ancient cultures. As the Centre for Archaeoastronomy made clear:

> The study of the astronomical practices, celestial lore, mythologies, religions and world-views of all ancient cultures we call archaeoastronomy. We like to describe archaeoastronomy, in essence, as the '*anthropology of astronomy*', to distinguish it from the 'history of astronomy' (my emphasis).[4]

Ruggles (2011, 1) continued:

> The term 'archaeoastronomy' has rightly come to define the field concerned not only with the disposition of monumental constructions and landscapes but also with artefacts, iconography, inscriptions, historical documentation, written accounts – in short every conceivable form of data that might provide insights into thoughts and practices relating to astronomy in the past.

The discipline then becomes less archaeological in a narrow sense and more cross-disciplinary, requiring familiarity with anthropological methodologies, the study of religions and the analysis of texts. The Centre for Archaeoastronomy statement distinguished the anthropology of astronomy from the history of astronomy but, as Ruggles pointed out, historical skills are necessary for the analysis of documentary sources and, in any case, the semantic boundary between history and anthropology was demolished in the debate between Hildred Geertz (1975, 71–89) and Keith Thomas (1975, 91–109) over the nature of magic, religion and astrology, and Hammond's paper (1970) on the difficulties of defining 'magic'.

The emphasis in archaeoastronomical research and publication since the 1960s has been on the European Neolithic and, amongst scholars in the Americas, the cultures of Mesoamerica, extending north into the modern USA, is on the prehistoric world. Some attention has been paid to alignments in Christian churches, Hindu temples, Polynesian sites and so on, but such studies only emphasise the pre-modern and non-western. Yet, there is no theoretical reason why archaeoastronomy needs to distance itself from the modern and the western, when neither archaeology nor astronomy attempts this feat. It is quite possible to study the space race under the general rubric of archaeoastronomy: space travel quite clearly concerns astronomy, while it has so far generated a fair amount of debris which could easily be classed as primary source material for archaeologists. Nevertheless, our main concern here lies with the ancient world, especially the Neolithic.

Studying the sky presents both opportunities and disadvantages. The major advantage is that the positions of the Sun, Moon and stars as seen from any terrestrial location can be reconstructed with great precision for any time on any day within the period we are

studying: accuracy may diminish with distance in time, but not to any degree that matters. As Michael Hoskin (2001, 17) wrote:

> It must be remembered that history of astronomy is a journey back in time to cultures alien to our modern thinking... the sky we can observe now is the same sky that prehistoric, ancient and medieval cultures sought to understand – (and) is the same sky that modern astronomers explore.

With good archaeological dating, in ideal conditions it is therefore possible to establish without any doubt whatsoever the key features of solar, lunar or stellar phases to which a key monument may be related. Of course, the phrase, 'without any doubt', is relative. And here we run into the first of our evidential problems: although the positions of astronomical bodies can be calculated with great accuracy, the ancient sky as a whole cannot be reconstructed in detail for any particular moment. We have no idea whether any one day was cool or hot, cloudy or clear, or windy or calm. We may know what time and where the Sun appeared to rise, but not whether it was gold, red, white or obscured by clouds. In addition, changes in archaeological dating together with uncertainty over the structure and function of sites, create problems of interpretation: at Stonehenge, for example, the consensus in recent years has altered from an emphasis on alignment with the Sun rise at summer solstice to the opposite point, the winter solstice Sun set, notwithstanding the entry of the summer solstice paradigm into popular culture. And, at any given stone circle, would the hypothetical Neolithic observer have been in the middle looking out, which is the standard model, or on the outside looking in? And, in any case, is 'observation' a modern concept anachronistically projected onto Neolithic culture? In this case we must learn from modern anthropology and 'bracket off' our own biases: as Ruggles (2011, 5) argued, 'We must move on from being a group of Western anthropologists 'looking out'. Such issues go to the heart of debates on some particular key sites. As Kim Malville (2011, 154–161) has argued in relation to the Peruvian monuments at Chankillo, the notion of ancient astronomers using prehistoric observatories should probably be replaced by concepts of ritual, shamanistic participation in a living cosmos composed of undistinguished sky and land (Ghezzi and Ruggles, 2011, 144–153). Norman Lockyer's statement from the early 20th century, cited by Ruggles and Hoskin (1999, 5) that 'the view that our ancient monuments were built to observe and to mark the rising and setting places of the heavenly bodies is now fully established', is therefore still plausible as a general statement, but difficult to demonstrate in many individual cases. As John Steele (2003, 247) cautioned:

> Astronomical dating can be a powerful tool for establishing absolute chronologies, but it is also a tool that must be used conservatively, for it can easily produce precise and impressive looking results based on invalid assumptions – results so precise and impressive they may not be questioned by scholars in other fields.

Equally difficult are changing fashions in interpretation. Ronald Hutton (2013) has drawn attention to political pressures, of which a key example is the influence of feminism in the development of notions of a Utopian stone-age matriarchy, and of changing models of ancient invasion and migration. And at this point we should invoke Jaquetta Hawkes (1967, 174) famous sceptical statement that 'Every age has the Stonehenge it deserves – or desires' (Bender 1998, 114). Astronomical evidence, then only exists in relation to wider cultural studies, a realisation which has resulted in the use of terms such as 'astronomy in culture', or 'cultural astronomy', the latter defined as:

> the use of astronomical knowledge, beliefs or theories to inspire, inform or influence social forms and ideologies, or any aspect of human behaviour. Cultural astronomy also includes the modern disciplines of ethnoastronomy and archaeoastronomy (Campion 1997, 2; see also Baity 1973, 389–449).

To an extent, the academic archaeoastronomers' move towards a multi-disciplinary approach since the 1970s is a response to the justified criticisms by archaeologists of archaeoastronomical work up to the 1970s, and of its tendency to operate solely from astronomical evidence and ignore the archaeological. The struggle between archaeologists and astronomers has been summarised by Clive Ruggles, who framed it within C. P. Snow's famous 'two-cultures' divide, first outlined in 1956 and forever after a metaphor for the intellectual gulf between the arts and sciences (Ruggles, 1999, 6). In retrospect, Atkinson's (1966, 1302) verdict on Gerald Hawkins' *Stonehenge Decoded*, which can probably claim to have kick-started modern archaeoastronomy, as 'tendentious, arrogant and unconvincing' is a fair one. On the other hand, Glyn Daniel's widely-quoted view of the New Grange solar alignment, (Daniel and Ó Riordáin, 1964, 19) as 'an example of the jumble of nonsense and wishful thinking indulged in by those who prefer the pleasures of the irrational and the joys of unreason to the hard thinking that archaeology demands', is somewhat extreme, and wouldn't now stand scrutiny. It is, though, widely cited as an example of archaeological conservatism, as by Martin Brennan (1994, 32). For Wilshire (1990, 145), Daniel's view was evidence of 'mimetic engulfment in one's group and unacknowledged exclusion of others'.

Yet, Daniel's view of archaeoastronomy is perfectly understandable if one doesn't distinguish between attempts to define archaeoastronomy as an academic discipline, as pioneered by such figures as Hoskin, Ruggles and Malville, on the one hand, and Atlantean fantasies about advanced ancient civilisations and extra terrestrial visitations, on the other hand. Daniel (1980, 71), who denied the distinction between academics and alternatives, wrote of archaeoastronomy:

> To me this is a kind of refined academic version of astronaut archaeology. The archaeoastronomy buffs, although they very properly eschew wise men from outer space, very improperly insist on the presence in ancient Europe of wise men with an apparently religious passion for astronomy.

To comprehend Daniel's view we have to understand the cultural context within which archaeoastronomy developed. Culturally, since the 1970s, the discipline of archeoastronomy has divided between those who seek an academic context, aspiring to rigour and peer-review, and those usually characterised as 'alternative' whose chief agenda is to demonstrate the existence of advanced ancient civilisations. The term 'alternative' can be misleading, for the alternative may be the mainstream, but it is the term we have, so use it we must. The alternative view also has important literary precedents, notably in the first major post-war work on the subject, by Gerald Hawkins (1965), which claimed that Stonehenge was a giant computer which might be used to predict eclipses. In 1966 the astronomer Fred Hoyle was asked by the journal *Antiquity* to check (and hopefully refute) Hawkins' eclipse predictor model. Although Hoyle found flaws in Hawkins' model, he instead produced a simpler, more effective, one. Hoyle (1966, 1972) then compared the builders of Stonehenge to NASA scientists, in his view challenging the conventional archaeological idea of Neolithic people as primitive. While Hawkins' work attracted wide attention, Alexander Thom's (1967, 1970) caused less of a public stir. It was, though, more difficult to refute on account

of the sheer extent of the precise surveys he used to substantiate his claim that megalithic sites were both laid out according to exact geometrical principles and precise solar, lunar and stellar alignments.

The cultural backdrop to Hawkins' and Thom's books was provided by two distinct cultural currents (Ruggles 1999, 1–7) First, and most obvious, was the 'space race', which began with the launch of Sputnik in 1957 and then moved via Yuri Gagarin's first manned space flight in 1961 to the Apollo moon landing in 1969. It was therefore natural, if anachronistic, for Hoyle to directly compare the megalith builders to NASA scientists and for astronomers, about to achieve their greatest triumph, to acquire a new set of distinguished ancient ancestors. The second was the social and political revolution of the 1960s: the widespread use of psychedelic drugs from 1965 onwards, the 1967 'Summer of Love' and the political radicalism of 1968, the 'May Days' in Paris and the anti-Vietnam war protests. The notion that megalithic culture was highly sophisticated encouraged its adoption as a pre-Christian, pre-scientific, pre-industrial alternative to the supposedly 'alienated' civilisation of the modern west which the disaffected radicals were busily rejecting (Campion 2002, 202–205). From this perspective Stonehenge has become the Westminster Abbey, perhaps the St. Peter's, of New Age, neo-pagan, Wiccan, and alternative and ecological spiritualities, a monument which supposedly recognises humanity's need for harmony with the seasons, sun, moon and stars rather than its dependence on a distant Judaeo-Christian God. The marriage between Thom, Hawkins and the emerging alternative spiritualities was effected by John Michel (1972) who, in the late 1960s, summarised their new theories in the pages of *International Times*, the London-based 'underground newspaper'. Michel's work is as much the seminal text of modern 'earth mysteries' and sacred geography, as Hawkins' and Thom's work is of archaeoastronomy.

Between them, then, Thom and Hawkins were responsible for the idea that Neolithic Britons were much like modern scientists, with an exact astronomy and precise surveying techniques, rather than stone-age savages. This had three effects:

1. It fed straight into the New Age movement, providing an apparent ancient lineage and authenticity for modern ideas of the interdependence of heaven and earth.
2. It contributed to the challenge to diffusionism, challenging views of the Neolithic period as essentially barbarous, as well as the theory that civilisation spread outwards from the Middle East, the 'cradle' of civilisation.
3. It encouraged the study of possible astronomical alignments in other cultures, particularly native North American and Central American.

Intrigued by astronomical investigations of megalithic sites, working separately to Thom and Hawkins, and attracting far less attention, Alexander Marshak (1964, 743) had published his first work arguing for the existence of lunar calendars dating back to 30,000 BCE in 1964. He identified these stone-age calendars in notches on antlers, tusks and bones. Marshak's work attracted little criticism and provides the only pervasive material evidence of a culture of astronomy in the late palaeolithic period (d'Errico 1989, 117–118). It was four years later, in 1968, that the term 'archaeoastronomy' was reputedly coined by Euan MacKie.

It was in such a context that R. J. Atkinson, who had first criticised Thom, then recanted his earlier opposition. He concluded that the megalith builders had indeed made an original contribution to European culture and that 'it is within the framework of this nascent model of prehistory that Thom's astonishing contribution will find its rightful place' (Atkinson

1975, 51). Atkinson gave a solid endorsement to Thom, berating his colleagues for their failure to accept the significance of his conclusions:

> I turn finally to the impact of Thom's hypothesis on the thinking of prehistorians. Here I incline. I am afraid, to a moderate pessimism, if only because so many of us have been trained, like myself, only in the humanities, and thus lack the numeracy required. But this is not the only barrier. It is important that non-archaeologists understand how disturbing to archaeologists are the implications of Thom's work, because they do not fit the conceptual model of the prehistory of Europe which has been current during the whole of the present century, and even now is only beginning to crumble at the edges. Part of the foundations of this model can be summed up in the phrase ex oriente lux – the idea that cultural, scientific and technological innovations were made in the early civilisations of the ancient east, and reached Europe only in a dilute and etiolated form through a slow and gradual process of diffusion. In terms of this model, therefore, it is almost inconceivable that mere barbarians on the remote north-western fringes of the continent should despot a knowledge of mathematics and its applications hardly inferior, if at all, to that of Egypt at about the same date, or that of Mesopotamia considerably later.
>
> It is hardly surprising, therefore, that many prehistorians either ignore the implications of Thom's work, because they do not understand them, or resist them because it is more comfortable to do so' (Atkinson 1975, 51).

Atkinson, though, had been seduced by the power of astronomy to intimidate those who are ignorant of its methods, a phenomenon already noted by John Steele. Nevertheless, prompted by the archaeological controversy over Hawkins' and Thom's theories, the Royal Society and the British Academy held a joint symposium in 1972 entitled 'The Place of Astronomy in the Ancient World' (Hodson 1974). From these and other discussions it soon became clear to the first academic archaeoastronomers that astronomical evidence alone was not sufficient to make a case. Intentionality became a key issue. For example, if an astronomical alignment is identified at a particular monument, how can it be argued that the alignment was intended rather than coincidental? Statistics might provide one answer: if a certain number of similar sites indicate similar alignments then it may be reasonably concluded that they were intended by the builders. Yet, a site such as Stonehenge is unique and its purpose might have been different to that of other, smaller circles and may therefore not be susceptible to statistical evidence. Perhaps, then, it was argued, ethnographic and anthropological evidence might provide additional confirmatory evidence for the existence of ancient astronomy. It was in this context, that Elizabeth Chesley Baity (1973) compiled her extensive survey of all the material published to date on astronomy in ancient cultures (excepting civilisations such as Egypt and Mesopotamia for which the literature was widely known), and the term 'ethnoastronomy' entered common usage. It was then recognised that multi-disciplinary approaches were required. As John Carlson (1978, 1) wrote:

> Archaeoastronomy is a centrifugal science, yet the focus is on a central problem in the development of civilisation and technological man. It yields results at the interfaces between many traditional disciplines and makes contributions in unexpected and personally rewarding ways. These new results enrich not only the individual disciplines but also contribute to the general understanding of the origins of science and the roots of human culture.

By 1977 there was sufficient interest for John Carlson to found the periodical *Archaeoastronomy Bulletin* (later renamed simply *Archaeoastronomy*) as the house journal of the Center of Archaeoastronomy[5] and, in the following year, the *Journal for the History of Astronomy* launched an annual supplement, also called *Archaeoastronomy.*[6] In September

1983, the Center of Archaeoastronomy organised, jointly with the National Air and Space Museum, the first international conference on ethnoastronomy at the Smithsonian Institute in Washington DC.[7] A strong emphasis on studies based on the Americas indicated both an expanding area of interest in academia, unencumbered by the baggage that was brought to studies of Megalithic culture by western archaeologists. The overwhelming focus on the non-western and pre-modern defined the area in anthropological rather than sociological terms, that is, about ‘them’ rather than ‘us’.

Separately, the first Conference on Archaeoastronomy was organised in Oxford in 1981. This conference was to be the ancestor of an ongoing series of ‘Oxford’ conferences, named after the founding venue. The second conference was held in Mexico in 1986, and the third in St. Andrews in 1990, the whole series up to 2011 producing a number of volumes of proceedings (Aveni 1989; Ruggles and Saunders 1993; Ruggles 1993; Esteban and Belmonte 2000; Ruggles 2011). At the time of writing the tenth in the series is scheduled to be held in Cape Town in July 2014. The term ‘Cultural Astronomy’ first appeared in the volume of papers derived from the third conference (Ruggles and Saunders 1993), and became part of the sub-title for the journal *Culture and Cosmos* in 1997.[8] Two academic groups have been formed to bring students of these areas together – SEAC (the European Society for the Study of Astronomy in Culture) and ISAAC (the International Society for the Study of Archaeoastronomy and Astronomy in Culture), the annual SEAC conferences also resulting in a series of volumes of proceedings (for example, Blomberg, Blomberg and Henriksson, 2003; Ruggles, Prendergast and Ray 2001; Šprac and Pehani 2013).

In 2000 *Archaeoastronomy* became ISAAC’s official journal, with the new subtitle, *the Journal of Astronomy in Culture*. In the same year the discipline gained academic recognition with the appointment of Clive Ruggles as the world’s first Professor of Archaeoastronomy at Leicester University. There is, though, a constant tension between those for whom astronomy, statistics and surveying are the main methodologies (so-called ‘green’ archaeoastronomy or ‘astro-archaeology’, as practiced by Locker, Thom and Hawkins) and those for whom the wider context, including the archaeological record and ethnographic evidence must be taken into account (so-called ‘brown’ archaeoastronomy) (Aveni 2008). A majority of researchers, judged by those who apply to speak at conferences, appear to be ‘green’, while the leaders in the field, judged as those who organize SEAC and ISAAC, publish books and edit conference volumes, tend to be ‘brown’, insisting on attention to the wider context and other disciplines: archaeologists are justified in their wariness over the kind of ‘green’ research which ignores the wider evidence.

During its progress through the 1970s to 1990s the new academic discipline of archaeoastronomy tended to withdraw from the extreme position taken by Hawkins and Thom in relation to Megalithic culture. The notion of a sophisticated Megalithic civilisation has, however, been appropriated by the advocates of the highly popular publishing genre which has come to be known as ‘alternative archaeology’, pioneered in the 1990s by such figures as Robert Bauval and Graham Hancock (Bauval and Gilbert 1994; Bauval, Grigsby and Hancock 1998). Alternative archaeology pits itself against its academic cousin by insisting that the latter routinely suppresses evidence for a universal ancient civilisation. Thus the back jacket of Adrian Gilbert and Maurice Cotterell’s 1995 publication, *The Mayan Prophecies*, claimed that the book reveals the ‘controversial answers the establishment “experts” refuse to accept’. The counter-argument is that alternative archaeologists play

fast and loose with the evidence, sacrificing rigour in pursuit of mythology. Essentially alternative archaeoastronomy has roots in late eighteenth and nineteenth-century concepts of an ancient universal civilisation, particularly those propagated by H. P Blavatsky (1982 [1888]) and the Theosophical Society.

We can see how Daniel's horror at the concept of archaeoastronomy arose out of the discipline's unformed and chaotic nature at the time: he appeared not to distinguish between the nascent academic discipline and the popular, New Age, version, perhaps because the academics were still too close to the Hawkins-Hoyle-Thom vision of an advanced ancient civilisation. Yet, the academics and the alternatives have continued to diverge. To adopt a Hegelian model, since the early 1970s the discipline has experienced its own dialectical process in which the Hawkins-Hoyle-Thom thesis, which remains paramount to this day within 'alternative' archaeoastronomy, encountered external pressures in the form of academic standards and archaeological criticism. The resulting antithesis, rejecting alternative models, has resulted in a new cross-disciplinary synthesis, in which astronomical evidence exists only within a matrix of methodologies drawn from the humanities and social sciences. Therefore when Timothy Darvill (1978, 97) wrote that 'No evidence exists for the use of stone circles as mathematical computers or for any other scientific purposes. Rather, the evidence can be economically explained as relating to the construction of simple calendar to aid the timing of rituals and the regularisation of the seasons', he opened the way towards a recognition that the use of the sky only exists in relation to culture. There is no need to imagine, as Hoyle did, that the megalith builders were just like us. We can allow them to be who they were. Similarly, Julian Thomas has emphasised the need for an integrated approach. Commenting on apparent solar alignments at the Dorset Cursus, he argued that perceptions of the sky were integrated with those of the land, neither was privileged over the other, but neither were they separate.

> These alignments on the sun and moon are not to be ignored, but monuments are just as often oriented upon other monuments, or upon prominent features of the landscape... What these orientations indicate is that astronomical phenomena were not privileged over an ancestral monuments or landscape features. In the case of the Dorset Cursus, the experience of watching the sunset over Gussage Hill depended upon the momentary coincidence of chalk from the earth, the descending sun, the dead in their barrow and the surrounding forest. This does not indicate any scientific observation of the heavens so much as a perceived unity of earth and sky, life and death, past and present, all being referenced to bring more and more emphasis on to particular spaces and places. This would tend to heighten the significance of whatever transactions and performances took place there. At the same time, it would also limit access to these spaces in terms of both direction and of timing, and would contribute to the way in which the space was experienced by promoting the impression that it stood at an axial point of an integrated cosmos (Thomas 2002, 146).

Considering Stonehenge, Julian Edmonds (2002, 147–148) wrote:

> The perimeter was reworked and many timbers were added, circles, facades and avenues suggesting processions and a growing emphasis on hidden rites. When the stones were erected to mimic timbers, authority may have been conferred on those who saw the sunrise along the avenue and over the heel stone at Midsummer...The proximity of the dead suggested a genealogical depth to the ties that bound certain people to the pace and all that it represented. Those who could sustain that link could work the ties between earth and sky in their interests.

As an academic discipline, archaeoastronomy may be best seen as narrowly concerned particularly with the measurement of astronomical phenomena in relation to the built environment. The wider field of cultural astronomy then necessarily brings in all those disciplines which study culture, chiefly history and anthropology. Even then, though, the term astronomy is still somewhat restrictive, carrying connotations of the modern scientific discipline, which are decidedly anachronistic when applied, say, to the Neolithic. Inherent in its use is the notion of scientific detachment. Yet, astronomy in the modern sense deals with only a part of the visible sky, the points of light we call sun, moon, stars and planets. The concept of skyscapes, though, allows us to apply the same language to ancient views of the sky as we do to landscapes, turning it from an object of impartial, observation which anticipates modern science, into the integrated part of a total environment, along with land, sea and all that live in them that is more familiar in the pre-modern and non-western worlds. As Hutton has cautioned, we should beware of romanticising Neolithic people as Rousseau-esque noble savages, but neither should we turn them into ancient astronauts. The concept of the skyscape, then, should be value-free, but it can assist in our search for evidence, constructing a fuller picture of ancient societies.

Notes

1 Cited in Hirst, Kris, 'An Interview with David Dearborn', http://archaeology.about.com/cs/archaeoastronomy/a/dearborn.htm (accessed 8 January 2013).

2 Archaeoastronomy, Sophia Centre, http://www.trinitysaintdavid.ac.uk/en/sophia/ [accessed 9 December 2012]. http://www.lamp.ac.uk/sophia/ma.html#archaeoastronomy [accessed 28 December 2009].

3 Clive Ruggles, http://www.cliveruggles.net/ [accessed 8 December 2009].

4 The Centre for Archaeoastronomy, http://terpconnect.umd.edu/~tlaloc/archastro/cfaar_as.html, [accessed 8 December 2009].

5 The Center for Archaeoastronomy, PO Box 'X', College Park, MD 20741-3022, USA. Tel: (301) 864-6637, Fax (301) 699-5337. The Centre's newsletter also carries news of the International Society for Archaeoastronomy and Astronomy in Culture. <http://www.wam.umd.edu/~tlaloc/archastro/>. The journal *Archaeoastronomy* is available from University of Texas Press, Journals Division, Box 7819, TX 7813-7819, USA.

6 *Journal for the History of Astronomy,* Science History Publications Ltd., 16 Rutherford Road, Cambridge, CB2 2HH, England.

7 The First International Conference on Ethnoastronomy: Indigenous Astronomical and Cosmological Traditions of the World, September 5–9 1983, Smithsonian Institution, Washington, program and abstracts available from The Center for Archaeoastronomy, PO Box 'X', College Park, MD 20741-3022, USA.

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3

An Examination of the Divide Between Archaeoastronomy and Archaeology

Liz Henty

There is a perception, which I share, that archaeoastronomy is sidelined in British mainstream university education in favour of archaeology which has a more respectable place in the academy. Many universities have archaeology schools or departments in the combined faculties of history and anthropology. There have been notable attempts to introduce archaeoastronomy into the mainstream, such as the undergraduate 'Introduction to Archaeoastronomy Course' that was run at Leicester University by Clive Ruggles until 2003 and the more recent introduction of the Archaeoastronomy Module as part of the MA in Cultural Astronomy and Astrology programme at Trinity Saint David University of Wales. Elsewhere archaeoastronomy is simply not on the university curriculum though it is possible that in some archaeology departments the subject is touched upon as part of the coverage of prehistory. However there is a difference between being aware of archaeoastronomical alignments and the ability to practice archaeoastronomy in the field. As both the disciplines of archaeology and archaeoastronomy investigate prehistory, particularly the vast legacy of megalithic monuments, which have enriched our landscapes since the Neolithic and Early Bronze Age, it begs the question of why archaeoastronomy appears to have been sidelined. This paper suggests that the reasons are historical and ideological as opposed to a failure of either discipline to make a valid interpretation of our megalithic monuments. It suggests that both disciplines suffer from the lack of skill-sets that the other employs and that the divide renders both archaeoastronomical and archaeological explanations incomplete.

Recumbent Stone Circles

If we look at a particular set of megalithic monuments, namely the Recumbent Stone Circles of north-east Scotland we can see the differing approaches of archaeoastronomy and archaeology. Recumbent Stone Circles which date to between 2500 and 1750 BC (Ruggles and Burl 1985, S25) are characterised by a large recumbent stone, flanked on either side by a tall stone pillar. The circle stones are graded in height towards the recumbent arrangement and the circles themselves are usually located near the summits of low hills, giving them extensive horizon views. Because the recumbent lies in the south-west quadrant of the circle, Alexander Thom (1967) proposed an astronomical explanation which suggested that the

Fig. 3.1: Loanhead of Daviot Recumbent Stone Circle.

Fig. 3.2: Recumbent arrangement at Easter Aquorthies Recumbent Stone Circle.

recumbent was aligned to the south-westerly lunar standstill settings. Following Thom's work in the nineteen sixties and seventies, Clive Ruggles and Aubrey Burl (1985) completed a further archaeoastronomical survey in the nineteen eighties examining 99 of these sites and, after subjecting their results to probability analysis, concluded that the orientation of the sites was significant. Burl (1979, 34) had previously concluded that the orientations were strongly influenced by the motions of the Moon yet theorised that the structures were generally not oriented on the rising and setting points of the Moon but rather the Moon high in the sky. Ruggles and Burl's later research found, like Thom before them, that the recumbent stone with its flanking pillars was aligned to astronomical events, particularly lunar ones.

As the science of archaeoastronomy was still in its infancy their research failed to take in an important factor when computing the results. In order to compute astronomical events

which are visible to observers, the angle of the horizon must be taken into account. Errors were also made in the classification of the sites and the list of 99 was whittled down to 66 in subsequent research. In 1999 Ruggles published *Astronomy in Prehistoric Britain and Ireland* which is effectively a textbook for archaeoastronomers. In it he subjected 66 of the recumbent stone circles to vigorous statistical testing and concluded (1999, 97) that the recumbents were oriented to observe the full moon passing low over the recumbent around midsummer each year. Generally there is a lack of artefacts found at the sites, though many of them have quartz scatters and cup marked stones which are associated with lunar symbolism (Thom 1998; Shepherd 1996, 152). These factors add strength to the archaeoastronomical lunar narrative.

However this explanation is open to question. Utilising statistical methods and astronomy, this single archaeoastronomical narrative with its concentration on the similarities common to a large number of sites, fails to examine their individual differences. It largely ignores the possibility of a sacred landscape and the colour and symbolism of the stones themselves. In addition, the research of Thom, Burl and Ruggles equally depends on the assumption that celestial events were viewed from the circle centre and then marked accordingly, though there is no archaeological evidence to suggest that the builders used a central post for a backsight. Ruggles (1999, 93) did acknowledge this problem and his results include the azimuth derived from the line perpendicular to the long axis of the recumbent as well as the centre line azimuths.

Having visited many of the circles, the apparent layout and careful positioning of the other stones, together with a perceived use of colour and texture made me question whether, by concentrating on the recumbent arrangement, other alignments in the circles had been overlooked. To test the existing theories I conducted further archaeoastronomical research which took a different voyage around the circles and concentrated on the circles in their entirety. This involved checking all the stones of the circle for solar and stellar alignments as well as lunar ones. Overall the results were surprising.

Initially I conducted a preliminary survey of 3 circles in order to assess the type of field work necessary for a full archaeoastronomical study. Latitude and longitude were established by converting eastings and northings read from OS Landranger Map 38. These results were checked using a Magellan hand-held GPS unit. Using a magnetic compass, east-west and north-south lines were pegged across the circle to establish an approximate centre. This centre was adjusted by measuring the resulting radii with a cloth tape. Dimensions from the centre to the left hand edge of each stone were marked on a rough plan. Measurements around the perimeter included the widths of the stones and the distance between them. This measurement gives a difference in the final perimeter value from that computed from the diameter using *pi* = 3.1416. Both methods can only give approximate values because the straight measure does not compensate for the curve of the line and the *pi* calculation is only accurate for a true circle (Henty 2010).

The main difficulty was establishing True North. Firstly north was found using a magnetic, prismatic compass and the results adjusted from magnetic north to true north using the then current (2010) correction of 3° 10' west. The readings did not correspond to Thom's north point. The GPS compass went completely haywire in the circles, presumably because of the granite stones. The only method left was to establish a north/south line using the sun. At noon in the northern hemisphere the sun culminates due south at 0º longitude. Local

noon depends on the angular distance from 0º and is calculated by using a scale of 15° to one hour in time, subtracting the time for longitudes west of 0° and adjusting for daylight saving. Having timed local noon, a line through the circle centre was pegged using the shadow cast from bamboo canes. This method compared favourably to the compass reading (Henty 2010). It is essential that the north point is plotted accurately as all measurements of azimuth depend upon it (Henty 2010). Plans were then drawn up from the data obtained. The azimuths of the stones were measured and then converted to declination to compare them with the declinations of the sun and the moon at important events such as solstices and standstills. As these declinations change slightly over time my calculations were initially made for 2000 BCE. My final plans were slightly different from those of Thom and this was because at every stage of the fieldwork there was room for error, from the stretch of the cloth tape to the difficulty of holding the heavy theodolite ranging rod completely vertical. I estimated a margin of error of 5° throughout (Henty 2010).

To test my theory that earlier research, by concentrating on the recumbent arrangement, might have missed other important clues about the construction and purpose of these circles I completed a detailed study of 9 circles. To address the fieldwork errors identified above two sets of existing plans were used; I did not myself draw up plans for these circles. The sites chosen were nine of the RSCs for which Thom had published detailed plans (Thom 1980). The second set of plans was the set of archaeological plans drawn by the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) between 1994 and 2005. These were provided by Adam Welfare. Of the RCAHMS' plans Welfare (pers. comm. 2010) says that they felt they were able to achieve a high level of precision but 'there is no escape from the fact that such evaluations cannot be perfect'. In addition the recumbent azimuths measured by Ruggles (1999, 213) were also checked. A comparison of the azimuths obtained did indeed show differences of between one and five degrees (Henty 2015). As there can be no certainty as to whether the builders used the centre of the circle as a backsight when positioning the stones I looked at the azimuth directly opposite the recumbent as well as the azimuths derived from the plans.

My fieldwork study found that theoretical positions of risings and settings are different from visible positions because of the horizon properties, so panoramic photographs were taken through 360° to establish the horizon altitude behind each stone. Each site had a hill top nearby, the height of which could be found on an Ordnance Survey map. Having calculated one or preferably more than one horizon altitude, lines could be drawn on the photographs by half degree intervals up to the measured hills. The altitudes along the entire horizon profile could then be worked out by extrapolation (Henty 2011a). Although this may not have the accuracy of the direct measurements of a theodolite it is a method that both Thom (1971, 68) and Ruggles (1999, 214) have used.

Not all of the circles have been accurately radiocarbon dated so I used the dates of 2500 BCE and 2000 BCE for comparison. To counteract the identified fieldwork error the declinations of the sun and the moon were checked ±2° either side of the azimuth of each stone. The sun and moon declinations used were those published by Ruggles (1999, 57) and as the obliquity of the ecliptic only changed by 0.05° in the 1500 year period the results would apply to any date between 3000 and 1500 BCE (Henty 2011a).

To date there seems to be little evidence that the sites have been checked for stellar alignments. The declinations of 48 of the brightest fixed stars for both dates chosen were

Fig. 3.3: Photograph of Sunhoney RSC showing how horizon angles may be calculated.

also checked against the azimuths of the stones. As there is no comparable research it was felt that as an exploratory exercise this research should check the declinations ± 1 degree either side of each stone's azimuth. Given that both lists covered all the declinations at which rising and setting stars could be seen at the circles' latitude, it is not surprising that nearly all of then were associated with a stone at one or more circle. However, most of these could be ruled out as occurring by chance. Where there was an alignment which occurred at three or more circles, these stars were looked at in more detail. For both periods some of these stars share the sun's and the moon's declination. It is possible that if stones were aligned to the sun and/or the moon then the appearance at that point of a rising or setting star as a horizon marker might have been important symbolically. It is not real evidence that the stars were considered when constructing the circles (Henty 2015).

The results summary (Henty 2011, 63) below uses the word alignment to denote a position where the azimuth of the stone matches the declination of a celestial body. It is not a statement of intentionality. Ruggles said (1996, 1) that in order to derive meaningful evidence on prehistoric astronomy, 'careful fieldwork is required, undertaken within well-researched methodological constraints, and subject to appropriate statistical analysis'. This study, whilst carefully undertaken, uses the methodology outlined above. Statistical probability analysis as advocated by Ruggles has not been attempted in this study: the results are expressed as simple percentages (Henty 2011, 58).

The results for solar alignments looked far more promising than expected given the weight of the lunar theory. All sites showed alignments to one or more of the sun's stations and four

Table 3.1: Table showing Results Summary for the sun and the moon.

Percentages of Solar and Lunar alignments for nine RSCs			
Sun	%	Moon	%
		Northern major rising	42.8
Summer solstice rising	57.1		
		Northern minor rising	14.3
Equinox rising	11.1		
		Southern minor rising	44.4
Winter solstice rising	66.7		
		Southern major rising	44.4
		Southern major setting	66.7
Winter solstice setting	55.6		
		Southern minor setting	33.3
Equinox setting	33.3		
		Northern minor setting	12.5
Summer solstice setting	50.0		
		Northern major setting	25.0

sites showed equinox alignments (Henty 2011, 59). As might be expected from the existing research there were five alignments to the winter solstice setting in the south-west. These comprised two stones, one east flanker and two west flankers giving an overall percentage of 55.6%. However, if only the stones of the recumbent arrangement are counted then the percentage falls to 33.3% (Henty 2011, 60). Additionally, 6 out of the 9 circles show pairings of solar risings and settings.

When it comes to the moon, if both major and minor lunistices are used then the possibility of finding lunar alignments is twice as great as the possibility of finding solstitial alignments, i.e. eight positions as opposed to four. Alignments to the major and minor setting limits in the southwest are those crucial to the prevailing lunar theory. For the major standstills the total of six alignments is just one more than the total for the winter solstice setting but if the minor standstill alignments are added the total increases to 9 which equates to 100%. The percentage for the recumbent arrangement is 77.7% compared to that of 33.3% for the sun though it falls to 66.7% if only the major standstill is considered (Henty 2011, 62).

Stellar alignments are more problematical because precise dating has to be used but there were stars which had percentage occurrences which are as great as those of the sun and the moon. Schedar and Capulus rising in the north-east and Bellatrix setting in the south-west have percentage occurrences which are as great as those of the sun and the moon. The percentage for Schedar and Capulus is 62.5% and the percentage for Bellatrix setting is 66.7%, its alignments including two west flankers. If positions opposite the recumbent arrangement are taken into consideration either from the centre line or perpendicular line data, Schedar and Capulus assume a greater importance (Henty 2011, 65). The starting and ending limits of the Milky Way are bounded by Taurus and Scorpio, more precisely by the two bright red stars, Aldebaran and Antares. There was some correlation between red stones and red stars.

When all the results for the sun, moon and fixed stars are considered, no definite conclusions can be reached, mainly because of the differences found between the circles,

combined with the small number of sites analysed. However, it cannot be safely said that alignments were overwhelmingly lunar; it appears that the sun and possibly some of the fixed stars were considered when positioning the stones. Additionally, whilst it is difficult to ignore the outstanding nature of the recumbent arrangement, my study reveals that if the circle is taken as a whole, a different cosmological pattern emerges suggesting that the movements of the sun, the moon and the fixed stars were incorporated into the design, perhaps as a microcosm of the sky.

Moving on from the archaeoastronomical explanations of these distinctive circles we can look at the archaeological narrative. Archaeologists have worked in a different way to build up a picture of the Neolithic and Early Bronze Age in Scotland. Archaeological investigations are not confined to one set of similar monuments: detailed excavations have been conducted at all types of stone circles, henges, cairns, barrows and mounds. They concentrate mainly on material artefacts to draw up of a picture of Neolithic technology which includes stone axes, arrowheads, beads and pottery. The assumption that a stable land-based culture is required for the construction of such impressive monuments adds weight to the theory that they are evidence of the shift from the Mesolithic hunter/gatherer economy to Neolithic agricultural and pastoral farming. The archaeologist Richard Bradley (2005) excavated three Recumbent Stone Circles and in his book *The Moon and the Bonfire* he reported that the centres of the sites were in use long before the circle of stones was added. He also suggested that the recumbent was the last stone to be put in place and that it symbolised a door which symbolically closed off the previous culture. He fully engages with the landscape properties of the sites and the symbolism of the stones, equating white with the moon and red with the bonfire as his title implies but does not carry out any further archaeoastronomical investigation. Obviously he considers the earlier archaeoastronomical theories but concludes that the Recumbent Stone Circles may have been directed towards the moon yet in some cases they may have faced the winter sun. Gordon Noble (2006) writing in *Neolithic Scotland, Timber, Stone, Earth and Fire,* pays little attention to archaeoastronomical theory, only concluding that Neolithic architecture incorporated elements of the builders' understanding of the world within the fabric of their monuments. In 2011, a major new archaeological account of the Recumbent Stone Circles by Adam Welfare (2011), entitled *Great Crowns of Stone* was published by The Royal Commission on the Ancient and Historical Monuments of Scotland. Welfare includes an overview of the antiquarian record and the most recent archaeological work together with an assessment of archaeoastronomy but *no* new archaeoastronomical research, concluding that (2011, 28) 'archaeoastronomy has failed to provide a convincing and coherent theoretical model …with respect to their orientation'.

History and Ideological Differences

So, despite the two disciplines of archaeoastronomy and archaeology continually honing their results and conclusions, it remains that here we have a distinctive set of monuments from which two separate interpretations have been drawn. This is not to say that either is correct or incorrect but there has been insufficient collaboration to integrate the findings. However, the results are not necessarily incompatible and it is a failure of both disciplines to utilise each other's resources. Archaeology employs a wealth of science-based techniques;

radiocarbon dating, soil and pollen analysis, dendrochronology, geophysical surveys utilising resistivity meters and magnetometers as well as the more recent forays into mitrochrondial DNA testing which has revolutionised our thinking about the origin of our Neolithic ancestors. Archaeology increasingly investigates the importance of rivers in relation to trading and meeting points, searches out wider patterns of occupation in the landscape through aerial photography and has developed landscape archaeology using Geographical Information Systems. It is stating the obvious to say that archaeology is ground-based. Given that there are inherent problems in a ground-based archaeological approach because of weathering, erosion and destruction of material evidence it is surprising that archaeology does not consider evidence of the use of the sky as an important artefact to be taken into consideration.

There is a great deal of anthropological evidence from other cultures which shows the importance of the sky and the celestial movements in their cosmologies. With the advance in astronomical software it is possible to see the sky as it would have appeared for any date in antiquity. This is because the heavens are governed by physical laws so the solar, lunar, planetary and stellar movements can be predicted retrospectively with a high degree of accuracy. Changes in the tilt of the earth, relative to the sun are measured by the obliquity of the ecliptic, the angle between the plane of the celestial equator and the plane of the ecliptic. This angle has changed from 24° in 2500 BC to just under 23½° today. This has an impact on where an astronomical event such as the sun at summer solstice rising can be seen on the horizon. Similarly, because of the proper motion of the fixed stars, their declinations change over time and there was no pole star in Neolithic times. We cannot go to a site today and see the sky that the monument builders saw. Before the advance in astronomy software which now allows visual reconstructions for any latitude and longitude and any azimuth in the world, archaeoastronomy could only explain its findings by scientific notation and astronomical language, much of which is unintelligible to anyone other than an astronomer. The prehistoric sky, now readily available, is an incredible but underutilised resource. It is a failing of archaeoastronomy that it has not managed to make its finds more accessible by using visual representations and it is a failing of archaeology that it has not learned the language of the sky.

I have used the research relating to the Recumbent Stone Circles to look at the current differences between archaeoastronomers and archaeologists. The circles are, in the Barbara Bender (1998) analysis, examples of ‘contested space’. Susan Stewart (1993, 143) suggests that our research is actually ‘an attempt to erase the actual past in order to create an imagined past which is available for consumption’. Archaeoastronomers imagine the past in terms of the sky and archaeologists imagine the past in terms of the earth. The explanation for their seemingly incompatible approaches has its roots in the development of the disciplines from their antiquarian roots at the beginning of the 20th century. Despite early astronomical studies by Lockyer (1908) and Lewis (1900), the role of astronomy was little considered until Gerald Hawkins (1965) published *Stonehenge Decoded* in 1965. There followed a wealth of New Age publications at the same time as Thom was publishing his first theories about lunar standstills and the scientifically minded priest-astronomers who designed the monuments. This was a very different model from that proposed by archaeology which had been influenced by Darwinian evolutionary ideas and the progression theories of Tylor (1871) and Lubbock (1865). The ‘Three Age’ system was used to order the finds and place them on an evolutionary scale. Thom’s ‘megalithic man’ was far removed from archaeology’s ‘primitive man’. There

Fig. 3.4: Simulation of Winter Solstice at Easter Aquorthies RSC, 2000 BC.

ensued an often bitter debate between archaeologists and archaeoastronomers fought out in the pages of academic journals, but processual archaeologists were more concerned with introducing their own quantitative methods and scientific rigour to be overly concerned at what was happening on the fringes of their discipline. Additionally, the only place where archaeoastronomy could find its voice in the British academy was alongside astronomy in the supplement of the quarterly *Journal for the History of Astronomy*; a publication which might be of little interest to archaeologists. At Aberdeen University Library Clive Ruggles' (1999) major assessment of megalithic sites, *Astronomy in Prehistoric Britain and Ireland* together with such works as *Archaeoastronomy and the Roots of Science* edited by E. C. Krupp (1980) are classified under the heading 'History and Philosophy of Science'.

In Britain, in the late 1970s further archaeoastronomical research was dogged by the controversy over megalithic astronomy and might have fallen further out of sight but for the commitment and enthusiasm of some archaeoastronomers. An interdisciplinary conference entitled '*Megalithic Astronomy and Society*' took place in Newcastle upon Tyne in 1979. Contemporaneously, in the New World, developments in Meso-American studies relied more on a combination of astronomy, ethnography and anthropology, a collaboration which fostered a session at the American Astronomical Society's 1979 conference entitled '*Archaeoastronomy – The Scope and Implications in Interaction with Other Disciplines*', held in Mexico City. Implicit in the conference session title and the historiography of the period is the assumption that archaeoastronomy is a discipline in its own right. Three leading members of the American Astronomical Society, John Eddy, Owen Gingerich and Kenneth Brecher encouraged by the attendance of 200 people at the archaeoastronomy session felt that if there could be a division within the Society that only required affiliate membership; members could include science historians and archaeologists. The new division was called the Historical Astronomy Division as they wanted to include 'uses of historical evidence for modern astronomy as well as archaeoastronomy'. The first meeting, which included papers for two full sessions, took place at the Astronomical Society's meeting at Albuquerque in January 1981. The afternoon session was devoted to native American archaeoastronomy. Having found their place in the academy, albeit under the umbrella of astronomy, leading

archaeoastronomers looked to expand the discipline by organising their own symposiums and academic journals. The first international conference on archaeoastronomy took place in Oxford in 1981. Writing in the proceedings preface for the second conference Aveni (1989, xi) says that the first conference was aimed at ‘a genuine interdisciplinary focus on questions and problems in ancient astronomy, one that would transcend both culture and method.’ However, the output of that conference was two volumes, one with a brown cover which dealt mainly with the interdisciplinary New World research and the other with a green cover dealing with astronomical alignments at the prehistoric sites of Britain and Europe. Aveni describes this as the green/brown dichotomy. The practical result is that the term cultural astronomy is more fitting for the route that New World archaeoastronomy continues to take. Old World archaeoastronomers in the 1980s remained focussed on alignments alone.

So in Britain, the Thom paradigm and ‘green’ archaeoastronomy continued to define the majority of archaeoastronomical research further dividing it from its archaeological critics. Aveni (1989, xi) reports that the first interdisciplinary Oxford conference was quite different from the conference on ‘*The Place of Astronomy in the Ancient World*’ held in London under the auspices of the British Academy and the Royal Society because it was more ‘scientifically more specialised’. However, much has changed since then, not least because of the efforts of Clive Ruggles who together with Nicholas Saunders (2008) argued in 1993 that the sky should be seen as a cultural resource and he continues to encourages the practice of an interdisciplinary approach to our monuments. Similarly Lionel Sims (2009; 2010) has adopted anthropological and phenomenological methodologies to complement the archaeoastronomical findings at Avebury. Additionally, archaeoastronomers (see Silva, this volume; Henty 2011) are widening their scope of vision to incorporate the entire landscape in which alignments are found, realising that monuments are not isolated constructions but built within landscapes and skyscapes filled with cultural meaning. Currently, The European Society for Astronomy in Culture or SEAC inaugurated in 1992 sees itself, according to its website as ‘a Professional Association of scientists working in the field of Astronomy in Culture or Anthropological Astronomy, including the interdisciplinary disciplines of Archaeoastronomy and Ethnoastronomy.’ Unfortunately it notably fails to attract archaeologists as delegates. The papers presented in this volume show how far the current discipline of archaeoastronomy has developed since those bitter debates of the 1980s. Archaeology too, with the development of landscape archaeology has progressed from its concentration on the particularity of sites to a deeper understanding of them set within their culture and environment, see particularly Richard Bradley’s (2012) *The Idea of Order*.

Of course there have been some extremely useful collaborations over the years, notably Thom and Burl (1980) and later Ruggles and Burl (1985) in their investigations of the Recumbent Stone Circles but these are generally exceptions to the rule. More promising work has recently been carried out by archaeologists Harding, Johnston and Goodrick (2006) on the Neolithic Monument Complex of Thornborough in North Yorkshire. Regretting the marginalisation of archaeoastronomy in the accounts of Neolithic Britain they used a three-dimensional virtual reality model to argue that the sites referenced the midwinter sunrise, Orion’s Belt, and other celestial phenomena. They conclude (2006, 48) that ‘it is only through considering archaeoastronomy as a normal part of a prehistorian’s armoury of aims and objectives …that we can fully appreciate the extent to which the skyscape was an integral part of beliefs and practices’. Ironically the full research was published in the

American *Archaeoastronomy* journal though a shortened version did appear in Barcelo's (2000) *Virtual Reality in Archaeology*. Hopefully work like this will inspire archaeologists to bridge the language gap between themselves and archaeoastronomers especially as according to Barcelo, archaeology is developing an interest in virtual reality techniques.

Conclusion

On the premise that archaeoastronomy is sidelined in mainstream university education in favour of archaeology I have tried to understand the reasons why this should be the case. This paper has shown how for historical and ideological reasons there has been a divide but suggests that the differences between archaeoastronomy and archaeology are superficial and surmountable given enough effort on both sides. Both disciplines have advanced their methodologies and outlook since the debates of the 1980s and the differences between the two are narrowing. Using the Recumbent Stone Circles as an example has highlighted the many differences between the disciplines which have rendered both interpretations incomplete. On the other hand I have used the work carried out at Thornborough as an example of where the two disciplines have acted in tandem to provide a more comprehensive interpretation. A full day's session of presentations by archaeoastronomers at the Theoretical Archaeology Group conference at Liverpool in 2012 and the publication of this volume are steps along the journey towards an understanding of an ancient worldview that encompasses earth and sky. Hopefully those presentations will help advance the course of a shared dialogue about prehistory and end the contested claims of archaeoastronomers and archaeologists. Interdisciplinary collaborations offer a real chance to enrich the interpretation of prehistory.

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4

Skyscapes: Present and Past – From Sustainability to Interpreting Ancient Remains

Daniel Brown

What exactly was the impact of the skyscape on ancient cultures and how could this experience be shaped? These are key questions when interpreting material remains of ancient cultures within the wider context of astronomy. One can only extrapolate backwards from our contemporary experience into the past. Therein lies a huge challenge since modern societies are generally less aware of the skyscape than their forefathers.

This chapter will show how a dark sky project offers a unique opportunity for individuals to see the need to negotiate the meaning and importance of the celestial environment through the current topic of sustainability, especially light pollution. Such raised awareness of the skyscape has established the idea that the cultural heritage of the skies that is worth conserving.

This real contemporary agenda will help to explore what the skyscape would have meant in the past by interpreting it as a dialectic image and embracing the place experience. Overall this work illustrates how the emotional connection is important to achieve a deeper understanding of a monument within its skyscape.

What are Skyscapes

Many ancient remains built by humans several millennia ago have a clear link to astronomy and encapsulate within them aspects of the daily rhythms of the Sun or the Moon and other celestial objects (e.g. Ruggles 1999). To confirm and support existing alignments it is often important to take not only the position of the celestial object into account, for example where the Sun rises or sets on the local horizon, but also the general landscape composition surrounding the monument. The interplay between land and sky may allow the emphasis of the meaning of a certain alignment and strengthen its impact. Stonehenge is such an example described by Cleal *et al*. (1995). While walking towards the monument along the avenue during the winter solstice sunset the Sun sets behind the central monument that appears to slowly rise from the ground. At the same time the duration of the sunset is prolonged. Both

effects are caused by the uphill slope of the avenue. Here we also have the opportunity to go beyond the pure statistical statement of a very likely intentional alignment and gain a glimpse at the deeper meaning of the alignment.

Understanding and analysing the meaning of an alignment encoded within the skyscape experience is further important since it can overcome some of the limitations scientific alignment searching encounters. Alignments can be pure chance and a statistical analysis of a large sample of similar monuments is needed to clarify which alignments are most probably intentional (Ruggles *et al*. 1984). However, this can only be applied if the monument is not unique as for instance Stonehenge or the standing stone at Gardom's Edge (Brown *et al*. in press). Furthermore, we are implementing our modern strict scientific stance of precision and rigor upon the ancient builders of such monuments and creators of alignments. If the alignment is not intended to be high precision a possible statistical signal might not be clearly apparent. Finally, certain alignments might be associated to celestial events such as the rising of the Sun at a certain day or the Moon at a certain time during its cycle that both can occur towards a common direction. Alignment searching can only indicate an azimuth or declination, and only in certain circumstances can it go beyond that to indicate the object of interest for which this alignment in its skyscape was intended.

Overall a skyscape consists of a multitude of components that includes celestial objects and the different facets of a prevailing world model or mythology which they represent. It also includes other locally constructed or natural monuments, geographical features such as rivers and sloping ground, as well as the local flora and fauna. It is especially important to realize that we are dealing with a nocturnal landscape seen either at night or in very low light conditions. Many ancient monuments manage to shape the impact the skyscape has on the observer as described above for Stonehenge. Understanding the impact of the skyscape on the observer and how this experience can be shaped is the next logical step to further shed light upon monuments with intended astronomical alignments.

Exploring the Meaning of Skyscapes

The effect of a skyscape can only be experienced by a contemporary observer and then extrapolated into the past to gauge what the builders of these monuments intended. For Neolithic or Bronze Age cultures this exercise might seem inconsequential since farmers and hunters still exist in our modern world and their interaction with the skyscape might be the same over the millennia. In general, analysis of the response from a small sample of members of our modern society might shed light upon how we respond to a skyscape. But this is deceptive since we have successfully removed ourselves from experiencing the night sky and a natural horizon. Increased urbanisation and light pollution has made us less aware of stars and the ever-shifting location of sunset and sunrises on the horizon. Therefore it is extremely difficult to engage at an appropriate level with the nocturnal landscape and the sky above an ancient monument. We are in need of a relevant angle that sparks interest in our modern society and allows us to more fully engage with such a monument.

Having established a hook for an audience, their engagement and their personal transformation following experiencing the skyscape needs to be analysed. At this stage we have to avoid current educational models that use a linear connection between knowledge and transformation. It is impossible to deduce from pure physical landscape parameters

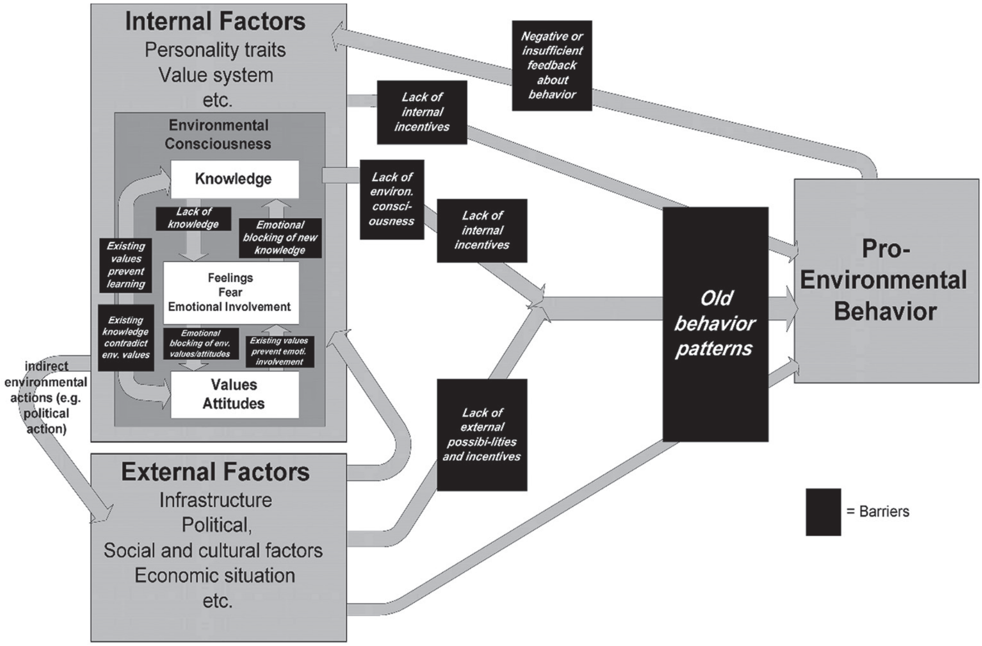

Fig. 4.1: The graphical and more realistic representation of how several reflective cycles lead towards transformation for the example of education for sustainable development taken from Kollmuss and Agyemann (2002). This diagram includes the emotional dimension often overlooked in educational theories.

and positions of celestial objects how this skyscape is seen or in other words perceived by an observer. Kollmuss and Agyemann (2002) have illustrated how, for the example of education for sustainable development, only a more intricate model illustrated in Figure 4.1 acknowledging critical reflection and the affectional dimension of learning (i.e. the emotional response caused in an individual through a learning experience) can fully begin to convey how transformation can be achieved. In our case we need to map emotions and feelings caused by a skyscape to assess how it impacts upon observers.

An empowering learning environment has to be created to enable participants to undergo such critical reflection and make them feel confident in listening to their intuition and feelings. Wenger (1998) describes these ideal environments, in which individuals are equal and there is no clear distinction between teacher and learner, as communities of practice. Everyone tries to *negotiate* a meaning to a posed problem (e.g. what is the impact of this monument and surroundings on us?), through discussions and confrontations within the group, rather than being informed about a single correct meaning.

A Contemporary Skyscape Experience

Recently sustainability has become a popular topic engaging many groups from the general public, universities, government, health service and industry. Sustainability addresses

the areas of environment, society, and economy. It is defined most commonly as "… development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (NGO 1987). Light pollution is one aspect of sustainability that is strongly linked with astronomy and has triggered significant action. Several dark sky parks have been created throughout the UK (Mizon, 2012), communities have initiated street light switch offs (BBC 2013) and TV programs such as BBC Stargazing Live have used this theme for some of their features. Therefore, this is an ideal topic that is relevant for our modern society in which members of the general public can fully engage with. It is strongly linked to preserving nocturnal landscapes and observing stars under dark skies. Both aspects are part of how a skyscape is explored and will provide an ideal case to successfully explore the impact of the skyscape that can be extrapolated to ancient societies.

The case used for this analysis is based upon the project "Astronomy in the Park" which is a Science and Technology Facility Council (STFC) funded project to support light pollution awareness based in the Peak District National Park. This national park was one of the first national parks created in the United Kingdom in 1951 and is located in the centre of England. This park is highly accessible since a third of the population of England live within one hour drive of it. However, it is also surrounded by large cities such as Manchester and Sheffield contributing to the large amount of light pollution encroaching on the dark skies of this national park. Together these two aspects offer a good opportunity to deliver the dark skies message to a large audience.

The project is a collaboration of the Nottingham Trent University, The Peak District National Authority and the Peak District Dark Skies Group. Rather than initiating large scale lectures and information events, we utilise ancient monuments and their surrounding nocturnal landscapes for outdoor learning experiences. This approach allows us to present the rich cultural heritage associated with such places. This experience is hoped to trigger a deeper connection and appreciation of not only the monument and surrounding landscape but also the dark skies. Historically, conservation matters regarding ancient monuments can trigger dramatic responses by the general public. Regionally this has been illustrated by the ten year long campaign of local communities against the opening of a quarry in the vicinity of the Nine Ladies Stone Circle (Badcock and Johnston 2009). In general one can imagine the public outcry if for example Stonehenge would have to be demolished to make way for a shopping centre. Our events demonstrate that ancient monuments are based within their skyscape and as such dark skies are part of our heritage and are in need of preservation as well. The general public will feel motivated to become active and support the reduction of light pollution.

The developed program was a mixture of small and large scale events that brought together a variety of participants that were not only astronomy groups and national park rangers, but also members of the local communities of all ages (12% were under 30 years and 10% were over 65 years) and backgrounds (2.7% black and minority ethnic and 5.5% with a limiting and long term illness). Together in groups the nocturnal landscape and monuments were explored using an inflatable planetarium to visualize the motion of the stars now and in the past, and also offered observing opportunities within the monuments themselves. Some venues included a short walk through the landscape at night enabling participants to notice light pollution but also to become familiar with a nocturnal environment not usually

Fig. 4.2: Participants of the "Astronomy in the Park" project within an ancient monument. Note the astronomy society and their telescope in the background (centre left) as an additional dimension to explore the local skyscape.

experienced at this time of day. The walk also included pointing out how one can read the landscape to uncover its ever-changing appearance, formed and shaped by humans in the past.

As an educational framework we applied critical place-based learning described by Gruenewald (2003). This approach combines two aspects: first, a critical learning experience which asks the learners to develop their own opinions and solutions to a posed problem and reject a general true or false approach; and second, a fuller appreciation of the place itself defined by all the meanings associated with a location by an individual. Overall it is the individual's own negotiation of meaning for a monument and its skyscape between the two opposing poles of preservation and re-colonization that are at its heart.

During our project we reached directly or indirectly more than 4,000 visitors through our events, permanent interpretation boards and an information stand at the BBC Stargazing Live 2012 event for the Midlands. The impact was monitored by evaluation forms and allowed us to gather information from 110 visitors from the directly engaged 400 visitors as seen in Figure 4.2. This data showed that our events were well received (with a 4.9 out of 5 satisfaction rating), and that visitors felt that they had learned a lot (with a 4.6 out of 5 education rating). We also enquired if the participants were interested in finding out more about astronomy or the cultural heritage of the region. The majority of visitors left the activities with the intention of finding out more on history (86.3%) as well as astronomy (92.7%). This data illustrates that we did manage to engage our audience and capture its attention. But as mentioned previously this pure knowledge will have to go hand in hand with an emotional response. Written and emailed feedback from the participants illustrated how such a response was achieved and the events and experiences were described as: "fantastic", "magical", "one could feel the history", and become "aware" or "one with the universe". It

also resulted in enquiries from many participants as to how they could personally combat the effects of light pollution or make sure unwanted light is reduced in their neighbourhood.

A more in depth study by Brown (2013) has just been completed using semi-structured interviews of seven participants which indicates that our activities have indeed achieved a heightened awareness and a transformation towards becoming pro-active in preserving dark skies. Furthermore work by Brown, Silva and Doran (2013) illustrates that this case is not unique. Other educational events tapping into a similar set of resources and educational ideas achieve the same amount of impact and transformation.

Fig. 4.3: Korean science teachers are using an ancient monument in the Peak District National Park as an outdoor learning experience to understand the seasonal movement of the Sun.

From Present to Past

"Astronomy in the Park" has allowed us to use the light pollution agenda as something that is relevant and of interest to the general public. Therefore it has been something that can be easily related to in every day live which is a key factor when posing such a theme as a problem and critically negotiating a solution (Wallerstein 1983). Since the project avoided the pure knowledge and lecture route, prone to impose the lecturer's point of view and generally ignoring any full engagement with a topic or problem, it can be used to shed light on how we experience a skyscape and extrapolate this to ancient societies.

One might argue that a contemporary audience might not approach a monument in the same way as an ancient society even when dealing with a common agenda. However, we would like to point out that firstly the experiences of the ancient monuments occurred in locations removed from the everyday surroundings of an individual as well as taking place at a time of day when we would otherwise remain indoors or in bright environments. Furthermore, during the events, participants did experience the sublime which they expressed as magical moments (a more detailed discussion can be found in Brown, 2013). Such brief events in time allow the participant to suddenly encounter something special which causes an emotional response that makes time and the universe become alive. Finally, having experienced this insight and transformation the returning participants are later supported in their work of spreading the dark sky method by a future project supporting dark sky communities and showcasing the successful transformation of participants to others. These three phases are identical to the three stages described by Van Gennep (1960) in the Rites of Passage model and has been put forward as a way ancient societies would have engaged with their monuments in a ritual fashion. Having established a similar approach to the monument we have improved the usefulness of the "Astronomy in the Park" project to gain access to what the impact of the skyscape was on ancient societies.

Our work has illustrated how important it is to experience fully all the different aspects of a skyscape. This goes beyond the pure knowledge about a skyscape but includes the seeing and interacting component. It is developed in more detail in Brown (2013) and can be briefly summarised as follows: Observers have to explore the entirety of what is offered to them and the skyscape turns into a huge canvas in which the observer is asked to reflect and find a meaning to their problems, beliefs and their own place within the skyscape. The outcome cannot be predicted as such since it is dependent upon the individual and is best described by Benjamin's dialectic image (Auerbach 2007). In this context a dialectic image can be understood as an observer that is transformed into a flâneur who wanders in mind and body. At some moment he experiences a sublime moment while being lost within this image. This interpretation including wandering is closely linked to psychogeography (Coverley 2007). Interacting with such a dialectic image is an ideal way of exploring the skyscape as a place, described by both Heidegger (2008) and Gruenewald (2003), that allows us to realise what this monument and skyscape really means to an observer and further to reflect on their sense of being. To capture these moments of realization it has become apparent that the time experience is something often overlooked. Becoming aware of the universe and its eternal rhythms in the sky above as well as the ever repeating seasonal cycles of nature, opens the mind to how our human existence in time relates to this larger system (Lefebvre 2004). Such ancient monuments manage to convey this time experience leading to a deep emotional response as evidenced by the participants expressing that they can feel

the history of a site. Most likely, this will have been the same in members of past societies. Additionally to a dialectic image the time experience has been outlined by Bergson (2008) as a moment at which we can again reflect upon our being and negotiate a meaning of both monument and skyscape. Bergson also stresses the importance of managing to generate a frame of mind at which the analytic mind is at ease and the affectional can take over fully in tune with the components of the skyscape resonating with the individuals feelings.

Conclusions

The theme of dark skies and light pollution awareness is an ideal topic that unites interests of our contemporary society to such an extent that a full engagement with the skyscape and all its components can critically take place. In particular the "Astronomy in the Park" project, which uses ancient monuments and cultural heritage to generate light pollution awareness has been demonstrated to allow for a more realistic extrapolation of how a skyscape might have had an impact on ancient societies. During the project, events were carried out that utilised ancient monuments as outdoor learning experiences and generated a resounding response in participants. Their reaction has illustrated the importance of experiencing the skyscape on an emotional level. This stresses that understanding a skyscape and its impact is not only based upon an academic analytical scientific point of view.

Overall, skyscapes and ancient monuments should be seen as outdoor learning venues at which one can learn about the Universe defined for one's culture and own being. In context of extrapolating backwards to ancient societies, it offers insight into how we learn and engage with a skyscape. Here it is important to realise that the angle to engage with a skyscape might be different and modern but who sheds light upon it is still an emotional human being striving to define his form of being, now and in the past. One modern example is the use of a standing stone by Korean science teachers in Figure 4.3. These aspects have been stressed by Brown and Canas (2011) and Pryor (2003). Such a skyscape will generate an emotional response, stimulate dialogue and trigger a full collaboration with a wide variety of groups throughout society. A skyscape will enable an observer to define the place-meaning of a monument that also reflects upon the temporal component. The skyscape can best be imagined as a virtual canvas upon which a dialectic image is cast offering the observer a path to negotiate a meaning to whatever question he will be posing, ultimately a way of negotiating his or her own meaning of being.

Common interpretations of astronomically aligned ancient monuments have often included the existence of an astronomy cast in their society that takes care of the intricate and difficult knowledge and skills to establish alignments and the eternal cycles of the sky. However, this work shows how this interpretation is a misconception derived from our scientific point of view of archaeoastronomy. Alignments are not difficult to set up when one engages with all the aspects and opportunities provided within a skyscape, such as the natural horizon profile. Experiencing the cosmic cycles is key towards being able to understand them and does not require advanced scientific knowledge. Here observing becomes exploring and interacting fully with a skyscape. The participants of our "Astronomy in the Park" event were in part removed from constraints of the modern society and did not have any specific scientific background; but they would have found the expression of cosmic cycles as something rather trivial given their deeper engagement. Constraints include equating night and darkness with

crime as well as obscuring the ever repeating seasonal cycles of sunset and sunrise through buildings. Especially important is the realization that current pedagogical models used to analyse outdoor learning experiences are ignoring the affectional dimension. A skyscape is something that has to be experienced through the mind and heart. Accomplishing this experience will then allow one to judge the impact a skyscape would have had in ancient times. Ultimately, this will give us a glimpse beyond the simple intentionality of an alignment towards the personal, cultural or spiritual meaning encoded therein.

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5

30b – the West Kennet Avenue Stone that Never Was: Interpretation by Multidisciplinary Triangulation and Emergence through Four Field Anthropology

Lionel Sims

Thinking from things alone is unable to attain the thick description required to interpret prehistoric culture. Post-processual narratives may offer plausible interpretations, but provide few guarantees as to validity. Interpretation at the level of meaning therefore requires reconstructing the lost complexity of ancient cultures which will allow discriminating between extant ethnographic theories (Sims 2009). Recovery of some of the past's material culture by archaeological site excavation, while a central methodology in this process, cannot achieve this reconstruction on its own. What is required is the integration of archaeology into 'four field anthropology'. This multi-disciplinary bridge between the sciences and the humanities in America includes archaeology, social and biological anthropology and linguistics. This chapter adds another discipline, cultural astronomy, as an additional tool to recover the ancient past. As each one of these disciplines amasses discrete data sets by different scholarly teams and different methodologies, each captures just a fragment of this no longer existing culture. These fragments will display a medley of characteristics, some distinct from all others and some that suggest convergence and connection with those from other disciplines. According to the relative richness and distinctiveness of each fragment it may be possible to discern the logically possible ways that each fragment can be combined with all those available. Combining the attributes of similar and different components allows a gradual accumulation of a higher level ensemble of attributes that fill out the original picture we had of this component from any single discipline with which we might begin. At this higher level they attain the level of meaning, which is unattainable by each discipline which considered each fragment in isolation. We may accumulate enough attributes to discriminate amongst extant scholarly theories that pivot on these integrated components. If we can reject all but one theory, then the one model that remains has stood the test of this procedure (Stinchcombe 1987). Without this multi-disciplinary approach, each discipline can stagnate around incorrect or partial models suggested by their in-house assumptions and paradigms. A multidisciplinary approach drastically reduces the number of possible interpretations. It allows reconstructing from partial fragments the emergent combinations that can only be generated by a specific and whole culture (Sawyer 2005)

and offers advances across a broad front of disciplines. Without such a multi-disciplinary approach that combines archaeology with anthropology we will continue to 'go round in circles' (Ruggles 2011, 3). We can explore the possibilities of such an approach at the late Neolithic/Early Bronze Age Avebury monument complex in Wiltshire, England, about 20 miles north of Stonehenge.

Keiller's West Kennet Avenue

The Avebury monument complex included the Avebury stone circle connected by the West Kennet Avenue, a double row of about 100 stone pillars, to the pillar and post circle Sanctuary about 2.4 kilometres to the south east (Fig. 5.1). The northern section of this Avenue was excavated and partially reconstructed by Keiller and Piggott in the years before 1939 (Smith 1965). Where no stones remained they placed concrete markers indicating where they had once stood. Leaving the Avebury circle and moving south east towards the Sanctuary, they labelled the stone row on the left as the 'a' row and those on the right as the 'b' row, and numbered this Avenue portion of pairs of stones or markers from 4–37. Stone positions 1–3, now under a modern road, were recorded by the excavators. Between pair positions 28–32

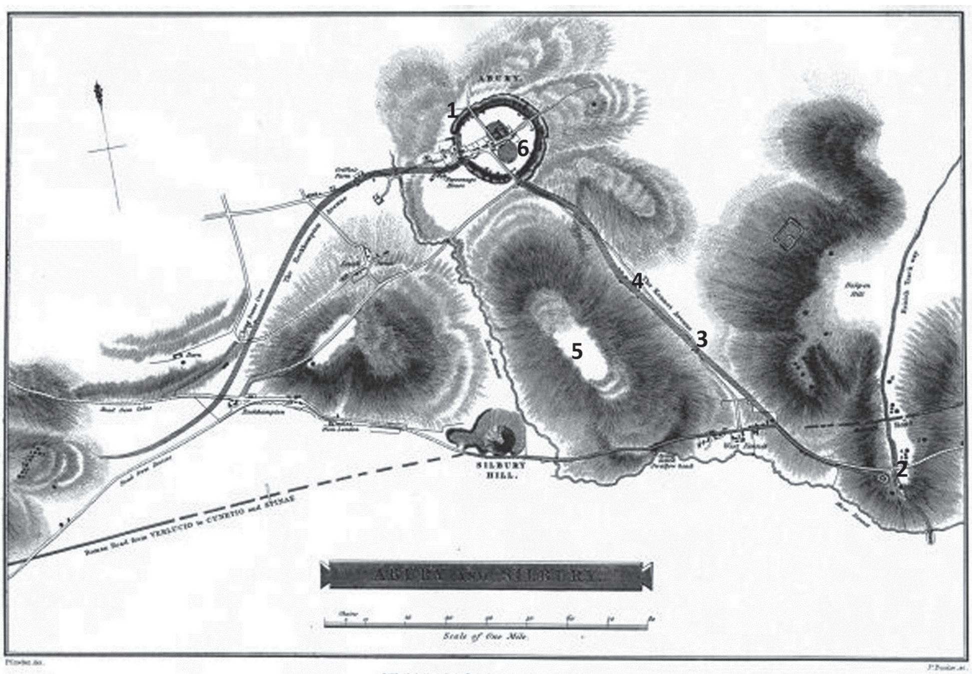

Fig. 5.1: The Avebury monument complex in its landscape (from Crocker 1823). Key to place-names mentioned in text: 1 Avebury henge and stone circle; 2 Sanctuary; 3 West Kennet Avenue; 4 Occupation Area; 5 Waden Hill; 6 Inner Southern Circle of Avebury henge; 'D' feature too small for figure resolution, but in the centre of the southern inner circle. Adapted from: Glastonbury 2001.

the excavators found a concentrated ‘litter’ of flint tools on the old ground surface and ten holes and two pits containing a ‘syntax’ of deposits including various types of ash, clay, stones and animal bones and deer antlers. They labelled this area the ‘Occupation Area’. The greatest concentration of flint tools focussed on the middle of this area at position 30b, where no Avenue stone was ever placed by the builders. Nevertheless the excavators placed a unique concrete marker at this position, presumably where they thought a marker ‘ought’ to be placed. A later re-assessment of the material deposited in the holes and pits, consistent with the original excavators assessment, has concluded that it is not typical of domestic waste or ‘lost’ artefacts (Thomas 1999, 64–69). The excavators had to admit that their assumptions as to the purpose and design of the area could not explain the evidence. “…[T]he holes…cannot be interpreted as adjuncts of normal habitation. It is difficult to evade the conclusion that this site has a direct connection with the Avenue and it is a coincidence worthy of remark that no evidence could be found for the existence of a stone opposite stone 30a…[T]he coincidence is a curious one.” (Smith 1965, 212).

In keeping with the then current assumptions of ‘farming revolution theory’ (Childe 1964), depositions within pits were used as a proxy marker for dwelling evidence in spite of the general absence of direct evidence for sedentary farming (Stevens and Fuller 2012). But by assuming that the pit material was a ‘midden’ (Pollard 2005) within an ‘Occupation Area’, this then led them to under-interpret the properties and structure of the deposited material. Keiller viewed the Avenue as a processional way for an agriculturalist fertility ritual to be conducted at the Avebury circle, and a gap in the line of Avenue pillars was anomalous to this model. He viewed lozenge and pillar stones as female and male markers which defined Avenue design. Yet around the largest surviving lozenge and pillar stone pair 13 there is no archaeology compared to the concentrated mass of material culture focussed around the vacant position 30b. Hence while Keiller labelled the area an ‘Occupation Area’ and erected a concrete marker at position 30b it was neither an occupation area, nor was a stone ever erected in this position, yet it was the centre of a large and organised mass of archaeology.

Archaeology of West Kennet Avenue since Keiller

Since Keiller and Piggott’s study of the Avenue, archaeologists have suggested three other models to interpret the West Kennet Avenue.

Thomas (1999) points to the average height of the Avenue stones being less than those of the Avebury circle so that those processing along it to the circle would have experienced a growing crescendo of power. Deviations around the average height of the Avenue stones may be more important. Instead of a gradual rise in stone height towards the Avebury circle the undulating height of surviving and re-erected stones matches the changing altitude of the background horizon when each is viewed from other stones at the eye-height of 1.65m of an adult Neolithic man (Brothwell and Blake 1966, and see Fig. 5.2). Even for an archaeology not schooled in the methods of archaeoastronomy, it is surprising that this property of the West Kennet Avenue has not been noticed. For the 26 stones which remain from the 74 stones for pairs 1–37, the property can be observed along all four dimensions of opposite pairs in both directions and across opposite diagonals and both rows extending along the whole visible Avenue length. This generates 125 stone relationships, of which 36 stone tops are below the horizon, 62 are in line with the background horizon and 28 are above the

Fig. 5.2: Examples of West Kennet Avenue stone heights with respect to their background horizons when viewed at the height of an adult Neolithic man. From top left clockwise these are stones 15a, 26b, 26a, 37b, 35a and 33b. Author's photographs.

horizon. Of the 28 stone tops protruding above the horizon 25 of them are when viewing stones 15, 14 and 13 which, as shown later in the paper, are predicted to do so according to the hypothesis of lunar-solar conflation. Of the three remaining stone tops that protrude above their horizon (35b when viewed from 37b; 26a when viewed from 27b and 35b when viewed from 36a), they become level with the horizon when each of them are viewed from their opposite pair. This reading suggests that the builders preferred the priority of across-Avenue coincidence of horizon level for determining normative stone height. All 28 above-horizon stones are therefore accounted for within the model being tested within this paper and do not diminish the claim of horizon-level stone tops. The stone tops that are below the horizon are also consistent with the model, since the phenomenological experience of seeing stones below the horizon mobilises the prehistoric cultural understanding of them and the observer being placed in a virtual underworld (Sims 2009). Of course this exercise is only conducted when travelling uphill, since all stones appear under the horizon when moving in the opposite direction downhill. Thus while power may well have been mobilised within Avenue rituals, this was mediated not through *stone height* but through *stone tops of varying height* referencing some horizon event.

Pollard (2005) claims that some of the ten holes in the Occupation Area held posts to mark an ancestral midden and that the West Kennet Avenue was a later lithic commemoration of this place of the ancestors. However none of the ten holes display the characteristics of post holes, since they are shallow and funnel to a point at their base. The excavators were clear that they were natural Coombe rock features of peri-glacial solution processes and could not have held posts (Smith 1965, 214–216). Nor does the concept of 'midden' explain the composition of or the structure within the archaeology. The flint tools are dense and are unusual or rare tool items and show no sign of wear. Rather than being distributed in a throw arc or as a waste tip, they are shaped in a cardinal zig-zag and match the layout of the later Avenue (Fig. 5.3). Hundreds of flint tools are concentrated around position 30b at the centre of this zig-zag array. The ten natural holes and two pits are numbered according to their excavation sequence, not their position along the Avenue, and are in two alternating lines either side of the Avenue. Holes 10, 8, 4, 3, 2, 7, 1 and 5 are aligned northwards along the 'b' row of Avenue stones from 32b and up to and just past the missing stone position 30b. From position 29a and along the 'a' row the two holes are supplemented with two artificial pits, and now continue northwards in P1, 11, 9 and P2 to just past stone position 28a. The two artificial pits are placed in positions which match the arrangement of holes 10, 8, 4 and 3 on the other side of the Avenue. Deposited flint tools and sarsen stones were common to all holes and pits on either side of the Avenue, but at the southern end of the sequence within hole 10 was placed the butt end of Type VII polished stone axe and at the end of this western line of holes close to position 30b was placed the cutting edge of a Type VII polished stone axe. Now changing over to the 'a' row of stones on the east side of the Avenue, an adult man is in a shallow 'grave' on the north east side of stone 29a in a thirteenth pit, and continuing northwards the two pits and two holes contain the fragmented remains of ox, pig, red and roe deer. Further along the Avenue at stone 25b were buried two adolescent boys and another man, and at 22b and 18b each stone had an adult man in shallow 'graves'. One of the adolescent boys had sarsen boulders crushing his head and the other had 'part of a humerus...forced through the jaw and well into the base of the skull', while the adult male at 18b had ante-mortem cuts on his femurs (Smith 1965, 210 and 230). Therefore the broken instrument of death and

dismemberment was distributed in the western row and comes before the deposition of two boys, four men and animal remains starting in the eastern row. The point of transformation hinges again around position 30b – the area where the greatest density of cutting flint was concentrated. Therefore symbols, instruments and products of blood, dismemberment and human sacrifice hinge around position 30b (Burl 2002, 132; North 1996, 539–543). Rather than this being a 'memoralised midden', by content and arrangement it would be more appropriate to characterise position 30b as some ritual turning point associated with animal and human blood sacrifice along the journey from the Sanctuary to the Avebury circle.

Richards (2004) sees the West Kennet Avenue as an empty construction that commemorated an ancestral journey into the area, but that once built had been then left and was not used for later rituals. No compression marks on the original chalk surface within the Avenue indicated little wear, and the inside of Avenue was naturally littered with many half buried sarsen stones that would have made processions difficult. But Gillings *et al*. (2008) point out that while no compression marks were found by Keiller *inside* the Avenue there are pronounced compression marks just *outside and alongside* the Avenue. This is consistent with and amplifies our finding that many stones when viewed as foresights from other stones as back-sights across and along the Avenue are so arranged that their tops are seen to coincide with the changing level of the background horizon. Those processing along the outside of the Avenue would therefore see a changing vista of stone combinations many of whose tops would be viewed in line with the background horizon. Both Richards and Pollard emphasise that the Neolithic ancestors were being commemorated in the construction of the Avenue, and suggest that its route traces their first entry into the area. If so the route chosen for the Avenue is not one that any experienced walker, or even less a hunter, would have chosen. No walker or hunter would sacrifice their elevation at the Sanctuary by following the Avenue route downhill to only then have to regain it twice when travelling over the undulating flanks of Waden Hill. Either a gradual ascent could have been made along the bottom of the dry valley or a hunter's view of the valley would be afforded from all along the edge of the eastern scarp. However we will see below that the paradoxical route of the Avenue affords the 'astronomical' advantage of asymmetrical horizon elevations along much of its route in this northern section with horizon altitudes of about 7° to the west and 2° to the east (Fig. 5.4).

In summary, archaeologists have suggested for the West Kennet Avenue a processional way for a fertility ritual, a power display, a commemoration of an ancestral route way, and a construction project. These four models cannot explain why the builders did not place a stone at position 30b, nor why there is a concentrated mass of material culture around this particular position but not, for example, at pair 13, nor have they noticed that the surviving Avenue stones exhibit horizon properties that suggest some 'astronomy' dimension to its meaning. In each case an *a priori* theoretical position has filtered out only a part of the excavated avenue material and design and not accounted for others.

Neolithic Discontinuity and Palaeolithic Continuity Refugia Theory

The standard Neolithic Discontinuity model of the north-west European Neolithic predicts the rapid adoption of sedentary farming. Assuming a prior forager 'primitivism', this model sees

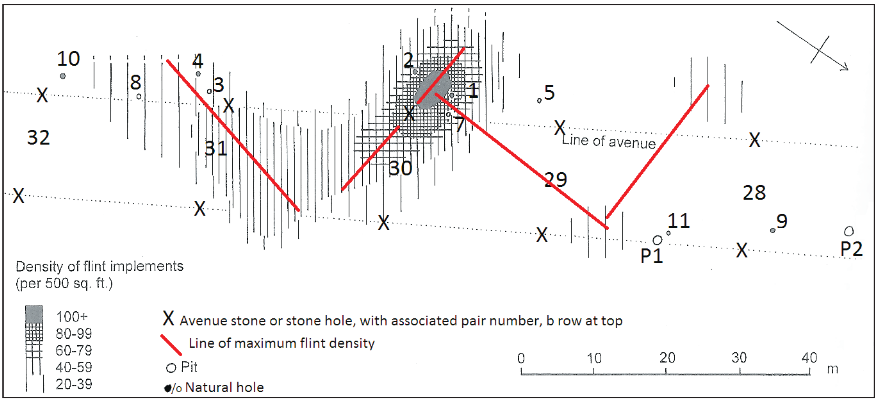

Fig. 5.3: Occupation Area of West Kennet Avenue. Adapted from Pollard 2005, 110.

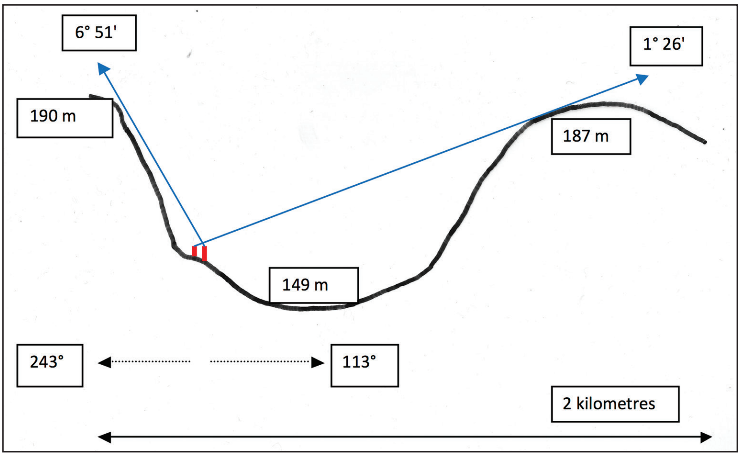

Fig. 5.4: Elevation Profile of West Kennet Avenue dry valley in Avebury, with horizon altitudes to south west and south east of avenue pairs (Origin = OS SU10756925; vertical axis not to scale).

institutional order and complexity being first established with and through sedentary living, out of which emerges male elites, the beginning of astronomy, writing and all other changes associated with 'civilization' (Childe 1964, 31; Renfrew 2001, 97). With particular reference to astronomy this model does not predict an early and sophisticated engagement with the moon, such as alignments on lunar standstills. The Neolithic Discontinuity model has been critiqued within archaeology by models of the gradual or punctuated adoption of agriculture by indigenous hunter-gatherers. For the period during which the Avebury monument complex was built it has been shown that the main economic strategy was cattle herding with the continuation of foraging and only occasional planting (Thomas 1999; Whittle 1996; Parker Pearson 2012). The late Mesolithic foragers who became the monument builders cherry-picked only certain components of the 'Neolithic package', such as domesticated cattle and pottery, and in becoming semi-mobile cattle pastoralists displayed a complex selective combination of

ancient forager and new Neolithic material cultures. It was not until the middle Bronze Age, around 1,600BC, that sedentary intensive farming began in Britain – the same moment that monument building ceased (Stevens and Fuller 2012). The gradual and punctuated models of the Neolithic, unlike the Neolithic Discontinuity model, therefore credit Mesolithic hunter-gatherer culture as resilient and already complex. This is consistent with and point towards Palaeolithic Continuity/Refugia Theory (Zvelebil and Zvelebil 1990; Frank 2008). The big game hunters of the western European Palaeolithic retreated to the Franco-Cantabrian refuge during the height of the last ice age and, from about 15,000 years ago, began to move out to populate west Europe. Most of the DNA of modern Europe is accounted for by this Palaeolithic ancestral population (Oppenheimer 2003). They and their African ancestors were fully evolved and cultural by 250 thousand years ago and some elements of their culture have been identified. Mitochondrial versus Y-chromosomal dispersion patterns show that hunter-gatherer sub-Saharan women tended to reside close to their mothers following marriage, migration rates for women being lower than those for men (Destro-Bisol *et al*. 2004). This supports the recent rejection in anthropology of the patrilocal band model, and hunting is now seen as undermining patrilocality and favouring mother-daughter links (Marlowe 2004, Alvarez 2004). Red ochre mining in southern Africa became general and sustained by 120 thousand years ago and Watts has shown that it was used as body paint symbolic of menstrual blood seclusion rituals (Watts 1999, 134). Lunar 'calendar' sticks, with emphasis on dark moon and waxing and waning crescent notation, indicate a Palaeolithic recording of the lunar cycle with a focus on dark moon (Marshak 1972; Ruggles and Cotte 2011; contra d'Errico 1999). All of this evidence is in turn also consistent with the cosmetic coalition model which predicts that matrilineal siblings motivated adult males from other clans to provision their women with hunted game, and synchronised menstrual seclusion rituals beginning at dark moon to end once meat was surrendered to them at full moon (Knight *et al*. 1995).

The introduction of domesticated cattle in the British Isles around 4,000 BC would have substantially changed the social and cultural dynamics of these foragers (Goldschmidt 1979). In marital relations a cattle owner could now provide a one-time payment of meat in return for a wife instead of performing years of hunting services. From a woman's point of view her relations with her blood kin were now attenuated if not broken, since it is in their interests to favour their newly acquired cattle over any redress she might request from them in her marital disputes. Where once a woman's siblings and mothers shared her interests in receiving hunted meat from her husband, now she is removed from them and monopolised by her husband (Aberle 1961, 680). A hunter had little incentive to have multiple wives since this would over-burden himself with hunting labours and there would therefore be a rough equivalence between men. Now, according to the size of a man's cattle herd, he could purchase more than one wife and direct their foraging services into his household. Men would become stratified according to differential cattle ownership. Young men would be beholden to senior agnates for cattle gifts to allow them to marry, and since ancestors in this culture are senior agnates releasing their cattle at death, then we would expect elaborate funeral rituals and ancestor worship to celebrate and sustain the circulation of cattle across age groups (Holden and Mace 2003, 110). Cementing these new wealth flows and marital alliances displaces a matrilineal coalition for patrilineal descent and patrilocal residence (Murdock 1959, 378). The patriarchal family replaces the matrilineal/matrilocal clan. Therefore when cattle bride price replaces hunting bride service it triggers gender reversal

and inequality (Alvarez 2004; Marlowe 2004; Goldschmidt 1979). To forestall or deflect the significance of the emergence of wealth inequalities monument building can simulate a 'sense of communalism' (Whittle 1996, 190), engendering the communal relations and structures which competing patriarchal families cannot, and through its rituals repair the cosmological narratives while displacing those which went before (Thomas 1999, 53). In the combination of these two models we preserve the legacy of continuity with the Palaeolithic but now through the discontinuity of a trans-egalitarian reversal of gender relations.

If this emergent model is robust it allows us to make a number of predictions. Monument design will display a complex cosmology confiscating and subverting an ancient lunar template. In particular we would expect that the great antiquity of sacred seclusion rituals at dark moon to be continued through modification more appropriate to a culture now led by wealthy cattle patriarchs instead of matrilineal clan coalitions of sisters and brothers. The ending of a wife's right to seclude herself with her blood kin at dark moon threatens to undermine the structure of ritual itself, which would have waxed and waned with the blood seclusion rituals beginning and ending with dark and full moon. The new men will have to step in to substitute ways to guarantee cyclical alternation between sacred and profane or otherwise it would seem that time itself would be imperilled. The lunar template and female register for ritual must become lunar-solar and male. I have labelled the archaeoastronomical element of this model 'lunar-solar conflation' (Sims 2006). In contradistinction to these expectations Neolithic Discontinuity theory would not expect any 'astronomy' or at most low fidelity alignments on the sun serving simple calendrical and religious purposes.

The Cultural Astronomy of West Kennet Avenue

Cultural astronomy is not included in this discussion as a preferred methodology, external to the site but implied by favoured models. The astronomy emerges from the unexplained archaeology of the cardinal (therefore astronomical) arrangement of flint 'debitage', the compaction of the land surface outside and not inside the Avenue, and the builders fitting of stone tops to background horizons when viewed from other stones. Critics of archaeoastronomy will have to suggest alternative explanations for these three properties. We can proceed by respecting these local details in our own method. Instead of assuming that the Avenue was composed of a series of straight sections (Thom and Thom 1976), or that it was made up from rectangular 'cells' of four stones (North 1996), we can use the stone pair as the unit of analysis. This does not preclude either 'straight sections' or 'cells', but what might be dismissed as 'errors' from an assumed ideal may reveal additional properties in their own right. Figure 5.5 shows the ten possible alignments from any pair of stones.

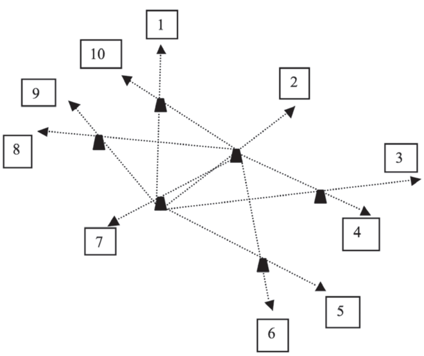

Fig. 5.5: The ten possible alignments across any pair of stones in the West Kennet Avenue.

The Avenue stones are large and close together, each pair of opposite, adjacent or

diagonal stones being about 14 m, 23 m and 27 m apart respectively (Sims, Field Notes). The angles subtended by a 2 m wide stone over these short distances are large – about 10° or 5° when viewing from opposite or diagonal stones respectively. These design properties preclude precision horizon alignments but allow creating the illusion of the sun and the moon rising from or entering into many of the stone tops when viewed from just *outside* of the Avenue. Such an artifice suggested the builders worked with a range of 5° to bring a horizon solstice or standstill rise or set within the top of a stone. By field survey 145 lunar, solar and cardinal alignments are found with this property along this section of the Avenue. These alignments are shown in Table 5.1.

Adopting these large ranges for establishing an alignment is an 'ethnographic' (Ruggles 1999) or 'religionist' (North 1996) hypothesis that breaks with the high fidelity assumptions of eclipse predicting 'astronomer priests' (Thom 1971). And for modern archaeoastronomy that has yet to embrace ethnographic modelling these ranges exceed standard expectations. To accept a range of 5° for the four solstice, eight standstill and four cardinal alignments allows 80°, or just over 22%, of the encircling horizon to be accepted as a target. To find any one alignment which could be generated by chance over 1 in five times would not pass the normally acceptable validity criteria. Therefore we need to establish whether 145 alignments would be accepted as beyond the bounds of chance.

Ruggles gives two statistical tests for finding the probability of a group of alignments occurring by chance alone. The probability of n orientations falling within Ø degrees by chance is given by $n(Ø/360)^{n-1}$, which in this case is 1.25535E-92 (Ruggles 1999, 95). An exponent with 91 zeros behind the decimal point that precedes the number 125535 is an improbably small chance occurrence. However it could be argued that this is a spurious level of confidence, since it could be that a straight Avenue with a regular horizon, simply through its direction, generates across its stones large number of alignments entirely by accident. An example would be the regular high ridge of Waden Hill running roughly parallel and alongside the Avenue. We test this null hypothesis by looking at *all* 362 possible pairings across 37 pairs along the northern section of the West Kennet Avenue with Bernoulli's law:

$$P = 1 - {}_{s=0}\Sigma^{r-1}\ n!/s!(n-s)! \times p^{s}(1-p)^{n-s}$$

where *r* is the number of target alignments found, *n* is the total number possible alignment combinations, *p* is the proportion of the horizon occupied by relevant astronomical alignments and s is the series of repeating calculations running from 0 to r-1 that must be summed (Hawkins and White 1966, 136; Ruggles 1999, 42–3).

Thom found six different straight sections to the Avenue between stone pair positions 6 and 37, separated from each other by changes in direction. It could be that within any single straight section that has a constant horizon the alignments are not independent of each other. For example between stone pair positions 22 to 18 are five alignments on north all with a constant horizon altitude of zero. The five stone pair positions within this straight section allow a total of 50 possible alignments within which were found 26 actual targets for a proportion of 0.22, or 22%, of the horizon. Applying Bernoulli's law gives the probability of this being a chance occurrence of 3.3111E-06, or just over 3.3 in every million times. Alternatively we may consider the north alignments alone for this section. In this case just 0.0139 of the horizon will be covered by the 5° boundary within which we accept an alignment on north. For the five targets on north found within the five possible pairings gives

the probability of this occurring by chance of 5.1889E-10, an even more unlikely event. So by both tests for this section the constant horizon to the north cannot explain the high number of alignments on either north or the remaining 21 alignments found across all 50 possible stone combinations. We can devise further tests of the null hypothesis. For example for the straight section between stone pair positions 6–14 the horizon remains constant for the two Avenue directions yet alignments across these stones change, while across stone combination 7 in this section there is a 4° change in horizon elevation yet a constant entrainment on the southern major moonsets. This complex interaction between direction, horizon elevation and alignment cannot be explained by random accident. A final challenge might consider the cardinal alignments on east and south, for example, as the unintended consequence of the reverse alignments on west and north. If so this would overstate the total number of alignments by 18, reducing the total count to 127. This would lower the probability of a chance occurrence of this new total to 1.77444E-81, still an improbable event. In conclusion we have found by statistical measures that chance alone cannot explain the 145 (or 127) 'astronomical' alignments found along section 1–37 of the West Kennet Avenue and that we can accept them as data.

This archaeoastronomy for the West Kennet Avenue cannot be explained by the Neolithic Discontinuity model. Instead of no knowledge of lunar standstills we find that of the 145 alignments 21 are horizon alignments on the solstices and 79 on lunar standstills. Interestingly 48 of the lunar standstill alignments are on the minor standstills and 31 on the major standstills. There is a structure within these alignments. I have shown elsewhere that the Beckhampton Avenue, Avebury Circle, and the Sanctuary were integrated in such a way as to view Silbury Hill as a facsimile of the moon before, during and after dark moon (Sims 2009). At strategic points along this route the view of Silbury Hill was to see its top in line with the background horizon, so stimulating the insight that the moon had just set. Since the only place from which the moon once set can be seen is the underworld, participants would thus simulate an initiatory journey through the underworld culminating in a dark moon ritual at the 'D' feature in the centre of the southern inner circle. If this model is correct it sets certain parameters for the design of the West Kennet Avenue. Since the Avebury Circle in at least its southern half is the place for a dark moon ritual, then the southern exit/entrance to the Avebury Circle of the West Kennet Avenue at stone pair position 1 must signify dark moon. By extension pair position 15 would signify full moon and pair position 30 dark moon. But since the average length of the synodic month is 29.5 days, then this provides an explanation for the missing stone at 30b, since it is the 29.5 pair from the entrance to the Avebury Circle. This should not surprise us as the count of 29.5 can also be found at Stonehenge in the half size stone 11 in the outer sarsen circle of 30 stones. This hypothesis is also consistent with the archaeology, since the cosmetic coalition model predicts that ritual seclusion would be organised for dark moon, which in turn requires a multi-media and redundant display of taboo invoking signals which includes the flow of sacred blood. With a model of social and gender reversal consequent upon the switch from bride-service to bride-price, we would expect the male monopolisation of ritual to incorporate their sacred blood rituals. This is further consistent with the archaeology of ante-mortem cuts upon male bodies and instruments of dismemberment found along the West Kennet Avenue. Does the archaeoastronomy support this interpretation?

Table 5.1: Alignments of West Kennet Avenue stone pairs 1–37 with adjacent and opposite stones.

Comb: Pair	1	2	3	4	5	6	7	8	9	10
1			SMinR					NMajS		
2								NMinS		
3				SMajR						NMajS
4		NMinR	South				SMinS		NMajS	NMajS
5			SMajR					North		
6	North	NMajR	East					NMajS		North
7		SSR		WSR				West	NMinS	NMinS
8		NMajR	East	SMinR	SMinR		SMajS		SSS	SSS
9		NMajR	East	SMinR	SMinR			West	NMinS	SSS
10			East		SMinR		SMajS		SSS	SSS
11			East		WSR				SSS	SSS
12		NMajR	East	SMinR	SMinR			West	SSS	SSS
13				WSR	WSR		SMajS	West	NMinS	NMinS
14		SSR		WSR			SMajS	West		NMinS
15		NMajR	East		SMinR	SMajR	WSS	West	NMinS	NMinS
16		SSR				South	WSS	West		
17	North		SMinR	SMajR	SMajR				NMinS	
18	North		SMinR			South			NMajS	NMajS
19	North	NMinR				South		NMinS	NMajS	
20	North	NMinR	SMinR			South	SMinS	NMinS	NMajS	
21	North			SMajR		South			NMajS	
22	North		SMinR					NMinS	NMajS	NMajS
23	North	NMinR	SMinR			South			NMajS	
24	North	NMinR	SMinR					NMinS		
25			SMinR							
26			SMinR							
27			SMinR					NMinS		
28	North	NMinR	SMinR							
29	North	NMinR	WSR			South				
30	North		SMinR							
31			WSR							
32				SMajR		South				
33	North		SMinR			South				
34	North		SMinR			South		West		
35		NMinR				South				
36	North			SMajR						
37	North	NMinR								NMajS

Note

For any pair of stones with adjacent pairs on either side, the ten possible combinations of pairings from the central pair to all six stones are shown in Fig. 5.6. These combinations are numbered clockwise 1–10 as azimuths from North starting at the northern diagonal and are the column headings in this table. The row headings identify the number of the stone pair positions 1–37. The azimuth bearings for zero horizon altitude at this latitude of 51° 25′ for lunar standstills, the sun's solstices and cardinal alignments (not to be confused with equinoxes) are: North 0°/360°; Northern Major standstill moonrise (NMajR) 40.5°; Summer Solstice sunrise (SSR) 48°; Northern Minor standstill moonrise (NMinR) 59°; East 90°; Southern Minor standstill moonrise (SMinR) 121°; Winter Solstice sunrise (WSR) 129°; Southern Major standstill moonrise (SMajR) 141.5°; South 180°; Southern Major standstill moonset (SMajS) 218.5°; Winter Solstice sunset (WSS) 231°; Southern Minor standstill moonset (SMinS) 239°; West 270°; Northern Minor standstill moonset (NMinS) 301°; Summer Solstice sunset (SSS) 312°; Northern Major Standstill moonset (NMajS) 320.

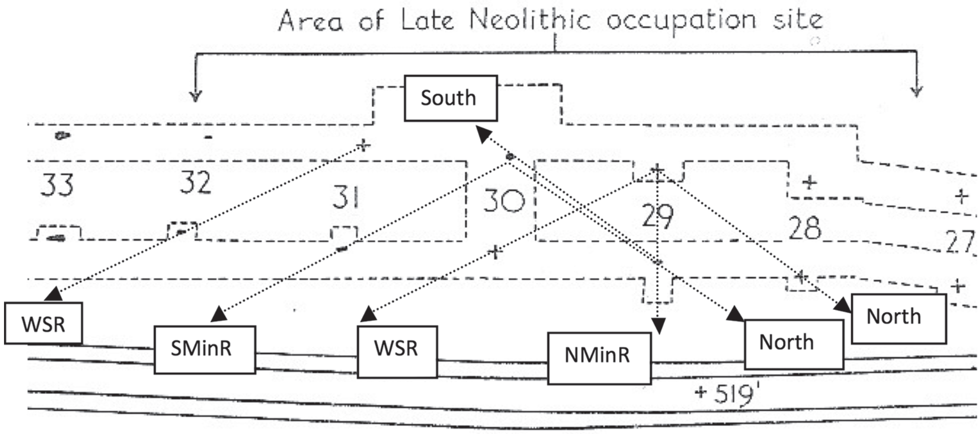

Fig. 5.6: All alignments across pair positions 29–31 of the West Kennet Avenue. The boxes outlined by a dashed line are Keiller's excavation trenches. Solid black mark is an extant stone; a cross is a stone-hole position. Dotted line is an alignment across stone or stone hole from positions 29–31. The 'b' row of the Avenue is at the top, the 'a' row at the bottom. Adapted from Smith 1965, fig. 71.

For pair position 30 there are just two alignments and both of them are along Avenue diagonals from position 30b – one to north across stone combination 1 and another to the southern minor moonrise across combination 3 (Table 5.1 and Fig. 5.6). Either side of 30b, and in parallel to its alignment on the southern minor moonrise across stone combination 3, are two alignments on the winter solstice sunrise from 29b and 31b. When the moon is at a major or a minor standstill the moon is always dark for the northern standstill at summer solstice and dark for the southern standstill at winter solstice (Sims 2007). Therefore position 30b prescribes alignments on dark moon at winter solstice – at the end of the longest darkest night. From stone 15b there is an alignment on the northern major moonrise across the Avenue over the top of 15a along combination 2 (Table 5.1 and Fig. 5.7). In reverse alignment from 15a along combination 7 looks over 15b on the winter solstice sunset. When the moon is opposite the sun then of course the moon is always full. Stone pair position 15 also has two solstice alignments surrounding it, but now on summer solstice sunrise across the Avenue from 14b and 16b on stone combination 2 rather than diagonally. And instead of an alignment on north there are diagonal alignments on west and east along combinations 3 and 8. Therefore stone pair 15 prescribes alignments on full moon at winter solstice, bounded either side by alignments of summer solstice. We have therefore found independent evidence for dark and full moon symbolism along this northern section of the Avenue, transposed onto solar cycles. And in bracketing a winter standstill full moon with summer solstice there is a diacritical alternation that turns the year. Instead of direct observation on the moon alone, as in the Palaeolithic, this is now through monumental horizon lunar-solar alignments. The symbolism of large stones (pairs 13–16) on the crest of a local ridge fits the depiction of full moon, while a space in an Avenue of paired stones at the 29.5 pair position fits the depiction of dark moon in the underworld. It follows that for the excavators to place a concrete marker at position 30b is an ethnocentric error that flows from the assumption of an uninterrupted Avenue, whereas the absence of a stone is perfectly consistent with our finding of the design

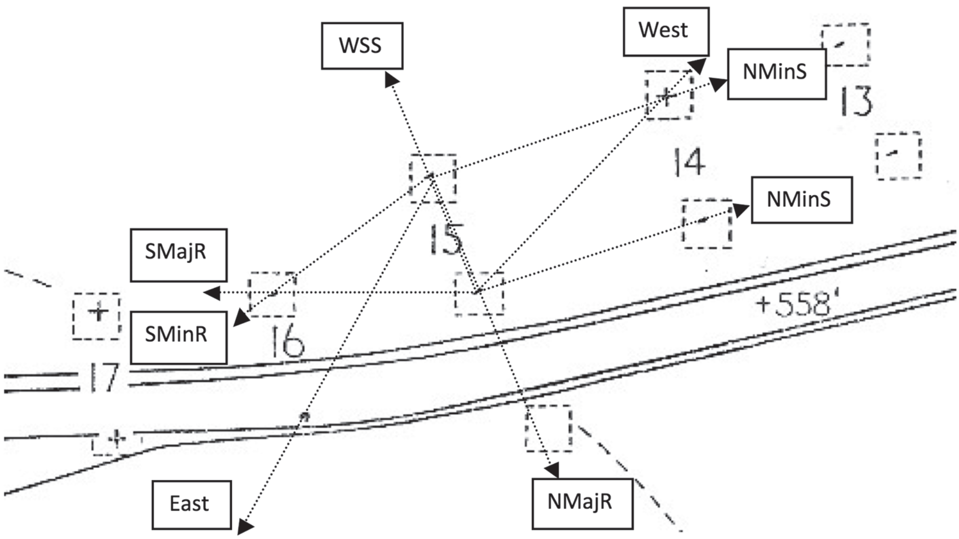

Fig. 5.7: All alignments across stone pair 15 of the West Kennet Avenue. Dotted line is an alignment across stone or stone hole from stone pair 15 alone. All other keys are as for Figure 5.6. Adapted from Smith 1965, fig. 71.

intention of signifying an underworld moon at winter solstice. Therefore we would expect this place, 30b, to be marked by a lot of 'archaeology' in and under the ground, *not* around pair 15. This is exactly what the archaeology reveals, and by integration with anthropology and archaeoastronomy we qualify all extant archaeological models of the Avenue.

From stone pair positions 37–15, looking west along combination 7, the high Waden Hill horizon runs roughly parallel to the course of this part of the West Kennet Avenue. While for the three sections from stone pair positions 23 to 37 the horizon altitude for all three ranges from 5° to 7.5°, within each section they have an *almost* level western horizon. This is similar to the horizon to the east, along stone pair combination 2, although now the horizon is in the range 1.5° to 2°. This allows a 'gearing' of reverse horizons across the Avenue of about a 5° difference in altitude. Since a single degree of altitude reduces the azimuth of a rise or set horizon position by about two degrees, and since at this latitude there is a roughly ten degrees of azimuth difference between adjacent solar and lunar alignments, a 5° difference in reversed stone combination's altitude generates a 10° change in azimuth, and will therefore allow a solstice setting to the west to be combined, Janus-like, with a rising standstill alignment to the east. It would be possible therefore to arrange the transverse paired stones to pick out an Avenue of standstill full moons rising out of the tops of the 'a' row of stones on east side of the Avenue. However while six alignments to the northern minor standstill moonrises can be seen between stone positions 23 and 37 there are no reverse alignments to winter solstice sunset. It is a very interesting finding of this fieldwork that the builders did not choose this option except at one point along the Avenue – at stone pair position 15 (Heggie 1981, 98). Yet here the altitude gearing is not the optimum 5° but instead is 3.5°. This explains what Burl (2002) considered a 'clumsy' alteration in direction at this part of the Avenue. Instead of being 'clumsy' it is a change in the alignment of stone

pairs from those adjacent to it to accommodate the design requirement which prioritises dark not full moon in a logic of lunar-solar conflation by cattle-owning patriarchs. This is why no stone was placed at 30b.

Conclusion

Extant archaeological theories are unable to explain the archaeology of the West Kennet Avenue. While Keiller's use of the Neolithic Discontinuity model assumes the Avenue's commemoration of an earlier 'occupation area', he cannot explain the paradox of an intentional gap in the Avenue at position 30b in the middle of an area that in fact does not contain occupation debris. Pollard's interpretation of the same area as a 'midden' cannot explain the syntax of pristine flint tools in alternating cardinal alignments synchronised with the Avenue design and focussed around position 30b. Thomas's power model of an ascending power of stones along the Avenue towards Avebury circle cannot explain the alternation of axe and cutting tools in a series of eight natural holes from 32b to 30b which switch to the burial of a sacrificed adult male and various dismembered animals in five holes and pits from 29a to 27a. The left-right alternation in thirteen holes and pits is focussed again around position 30b. Rather than an incidental detail the Avenue gap at position 30b emerges as an isomorphic fulcrum repeated across a range of archaeological materials. In addition all researchers until now have failed to notice that the surviving Avenue stones from pairs 37–13 fluctuate in height to be level with their background horizons when viewed at the average height of an adult Neolithic man standing just outside the Avenue alongside other stones.

This paper has argued that these Avenue details can inform the integration of archaeological, anthropological and archaeoastronomical theory. The recent archaeological critique of the Neolithic Discontinuity model now allows conceptual integration with anthropological models. This generates a new emergent model of cattle-wealthy patriarchs monopolising ancient dark moon blood rituals by transposing them onto solar cycles. Since archaeology has already established the cardinal, and therefore astronomical, arrangement of the surface flint tools and since this paper has demonstrated the normative arrangement of stone tops in line with the background horizon, the archaeoastronomy of the West Kennet Avenue can be mobilised to test and enhance this new model. This exercise reveals a repeat in the isomorphic structure already found within the archaeology – position 30b is shown to combine a lunar-solar paired alignment on dark moon at the winter solstice. I have therefore shown by multi-disciplinary componential method links across different disciplinary data sets which display identical isomorphic structures. Flint, stone and bone are indistinguishable with 'astronomy' for sharing a break point at position 30b in the West Kennet Avenue. Once the content of all these isomorphic elements are integrated they reveal system level meaning congruent with the model of a male cattle-herder monopolisation of lunar-solar ritual confiscating ancient egalitarian matrilineal lunar rituals. This method of 'emergence' restores by reconstruction this part of the West Kennet Avenue to allow interpretation to reach the level of meaning.

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6

Can Archaeoastronomy Inform Archaeology on the Building Chronology of the Mnajdra Neolithic Temple in Malta?

Tore Lomsdalen

The Maltese Temple Period is reckoned to be from around 4,100 BCE to 2,500 BCE whereas Mnajdra itself is listed to be constructed in Ggantija (3,600–3,000 BCE) and Tarxien (3,000–2,500 BCE) phases with a short intermediate Saflieni Phase (3,300–3,000 BCE). Archaeology does not seem to produce clear evidence of the building sequence for the Mnajdra complex which consists of three distinct structures. Arguments are mainly based on typology, not stratigraphic evidence, which makes chronology precarious. Archaeologists in general seem to agree that the small trefoil temple is the oldest and the middle temple the most recent. The intricate south temple, or parts of it seem to have been constructed sometime in between the two other temples; however, there is no clear evidence of a definite building sequence for the various rooms within the temple itself. Part of its construction may be contemporary with the small trefoil temple or even before it.

The Mnajdra Temples, especially the south one with its clearly defined eastern orientation, have created much enthusiasm since the 1970s for astronomical and archaeoastronomical research by both scholars and laymen as it gives an impression of being intentionally constructed to establish time and season through the oscillation of the sun's yearly cycle along its apparent horizon. Papers on the astronomy or archaeoastronomy of the site seem less concerned about the architectural building sequences. Based on Mnajdra's archaeological evidence, its architecture, field observations and horizon astronomy, this paper proposes a redefined building sequence for the lower and middle temples, which were conceived and built over a period of about one and a half millennium. Where archaeology alone does not provide conclusive evidence or indication, archaeoastronomy may provide supplementary data to help establish a possible building chronology.

Introduction

Mnajdra is probably the most atmospheric of all the temples on Malta (Trump 2002, 148). It is situated in a gentle depression formed by converging hill slopes on the southern cliffs

Fig. 6.1: Aerial view of the Mnajdra complex with the small trefoil temple at the right, the north temple at the top, and the south temple in the bottom-left. By courtesy of Daniel Cilia.

in the south-eastern coastal area. There are no modern buildings or structures in sight and it has a scenic view over the sea and the rocky islet of Filfla. At first sight the landscape where Mnajdra is built appears barren and inhospitable; however, it offered all the resources necessary for a community 5,500 years ago (Stroud 2010, 5). The temples are built from both the harder Lower Coralline Limestone which one finds on nearby cliffs dropping into the sea and the softer Globigerina Limestone which is available less than 200 metres from the site. Mnajdra, like the nearby Hagar Qim temple, has never disappeared since the time it went out of use in prehistory, though old photos and drawings show that the temple has suffered disorder and damage, however, the core structure seems to be archaic. Mnajdra has gone through considerable restoration work since the first known excavations at the beginning of the 20th century. However, its central features are fundamentally well-preserved and the overall feeling to a visitor is of an archaic structure (Evans 1971, 96). Pace (2004b) also concludes, referring to the south temple that, it is highly probable that much of the original Ggantija Phase construction still stands intact.

The Temple Period in Malta goes from the Early Neolithic (4,100 BCE) until the Early Bronze Age (2,500 BCE); for the Mnajdra complex the core time frame is the Ggantija (3,600–3,000 BCE) and the Tarxien (3,000–2,500 BCE) phases (Trump 2004, 230). The Mnajdra temple complex consists of three distinct temples or structures, as seen in Figure 6.1.

This fields research programme was conducted over a period of nearly three years with on-and-off visits to the site. Observations at equinoctial and solstitial periods were prioritised as the question of whether the temple was intentionally aligned and oriented

towards celestial bodies, especially the arc of the sun's movements throughout the year on its eastern horizon, was the chief topic of investigation. In this context the question of chronology and building sequence was investigated, both from an archaeological and an astronomical standpoint. However, to be clear, it was the archaeology of the monument that first sparked the idea of astronomical considerations as supporting elements for a redefined sequence of building chronology. Excavation reports and other material from archaeological investigations give an impression of consistency on a larger scale when it comes to the three distinct temple structures. Treating each building separately, there seems to be a lack of agreement regarding the building sequence. On the other hand, astronomical and archaeoastronomical investigators in general, seem less inclined to consider chronology and more easily accept temple architecture as it presents itself in modern times. This is paradoxical, since their work does note the differences between the positions of the stars and planets during the Temple Period and their present placement.'

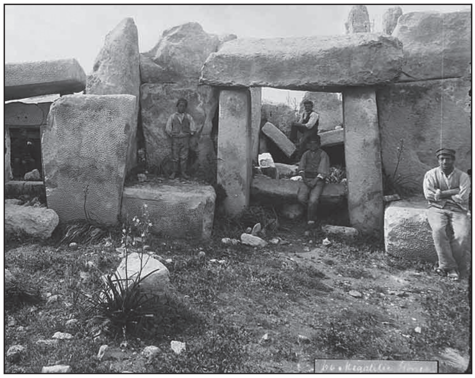

Fig. 6.2: Photo of Mnajdra South assumed to be from the last decades of the 19th Century, before restoration work (Ellis 2011, photo 8, pp. 12–3, with the courtesy of "The Richard Ellis Archive – Malta").

From this stance, this paper aims to investigate whether archaeoastronomy can provide supplementary data to aid the establishment of a possible building sequence for the Maltese Mnajdra south temple where archaeological excavations and observations seemingly fail to provide clear chronological evidence. The question of whether Mnajdra was intentionally constructed to face specific predetermined natural objects or aligned to celestial bodies is addressed. The study is based on archaeoastronomical fieldwork and photographic documentation. Distances were measured via a hand-held GPS (Garmin 12); given azimuths and horizon altitudes were measured using a Suunto compass and clinometre tandem. Naked-eye astronomy at certain times throughout the year, close to the equinoxes and solstices, proved to be of special importance throughout this study.

The first decision that the prehistoric builders would have made was the orientation of the axis along which the portal structures were to be erected (Torpiano 2004, 360). As it seems the builders put considerable work, effort and skill into the axis of orientation of their still enduring megalithic temples, it could indicate a directional intentionality; Torpiano concludes that the concave façade present in most temples confirms the importance of the axis of orientation. Evans (1959, 125) on the other hand, claims that orientation seems not to be an important factor to the temple builders, although he maintains that 'mostly the entrances face in some direction between south-east and south-west.' Evans further concludes that exceptions could be found and 'that it seems that orientation was not important.' When it comes to Mnajdra South, Trump (2002, 148–151) agrees with Evans' point of view on temple orientations and only goes as far as stating that an 'astronomical alignment has been suggested'. Nevertheless, from personal communication with the author of this paper, Trump seems not to reject alignments towards the equinox and the winter solstice sunrise, however,

he finds the summer solstice sunrise alignment less convincing as the illumination on the vertical orthostat is wider than on its counterpart for the winter solstice sunrise (Trump 2013).

Vance (1842, 232) who attributed the temples to the Phoenicians, is the first to associate the temples with a celestial relationship, and believed the temples were not roofed and therefore appropriate to the worship of the heavenly bodies and for paying homage to the sun, moon and the stars. Vance (1842, 233) further suggests one particular high stone at the Hagar Qim Temple, Mnajdra's next door neighbour, was 'raised for the purpose of tracing with greater accuracy the motions of the different planets'. Zammit and Singer (1924, 68) suggest that 'No definite rule of orientation seems to have governed the construction of these buildings, nevertheless, Zammit (1929b, 13) relates the temples to astronomy when he suggested that the pits dug out of a recumbent slab at the entrance to the Tarxien Temple represented the image of the constellation of the Southern Cross; according to Agius and Ventura (1980, 20) it was easily seen in this hemisphere during the Temple Period. Ugolini (1934, 128) proposes that the Tal-Qadi Stone which apparently indicates a crescent half-moon and stars, as a possible Neolithic 'la lastra astrologica', presumably meaning a piece, sheet, slab or a chart of astrology or astronomy, (text translated from Italian by the present author). Studies conducted by Agius and Ventura (1980, 9) and later by Cox and Lomsdalen (2010) concluded that the orientation of most temples range from south-east to south-west and show consistency of bearing, suggesting that some temples were intentionally constructed to face particular directions. In a survey of 14 orientations, Fodera' Serio *et al*. (1992) found them all within the range 125.5° to 204°, less than a quarter of a circle, and concluded that, 'such a concentration of axes cannot have come about by chance.' In the Mnajdra complex this author (2011) argued that the three temples seem to have a well-defined orientation along their central axes. The small trefoil, or East temple, has a south-west orientation, whereas the five-lobed middle, or North, temple is orientated towards south-east. The five-lobed lower, or South temple, is oriented towards an eastern horizon that slopes down towards the sea which is about 500 metres away (as estimated by the present author's GPS readings). The South temple is atypical in that it is the only extant temple on Malta with a well-defined orientation towards the east.

Archaeological Excavation History

Abela (1647, 145) is the first known person to have written about the Maltese temples, suggesting that they were built by giants. Until Zammit and Singer (1924, 67–68) rightly suggest that the temples ' are all of neolithic age' based on the theory that no metal had reached the island at the time when they were raised, it was commonly accepted that the temples were Phoenician or Roman antiquities (Caruana 1882). The Frenchman Lenormant was the first to excavate Mnajdra in 1840, with no published report (Zammit and Singer 1924, 71). The Mnajdra remains were generally only cited in passing and usually in connection with their next door neighbour, The Hagar Qim temple, until Fergusson (1872, 418–21) gave a fuller description with a small-scale plan of the site. Caruana (1882, 14–17) reported the state of the monument in early 1880's, but according to Evans (1971, 95) the illustrations were simply a reproduction of Fergusson's. Whether Mnajdra was actually excavated or merely cleared during the earliest archaeological works, is not clear, however, both Ferugsson (1872,

418–422) and Caruana (1882, 14–7) reports seem to give a more illustrative description of the site. The first adequate descriptions of Mnajdra were given by Mayr (1901, 654–664) who also made a satisfactory plan which, nevertheless, did not mention or indicate the small trefoil east temple. In 1910 Ashby (1913, 90–105) devoted about 10 days to Mnajdra and as Evans sustains (1971, 95), 'excavated those parts which had not been completely ransacked by the original excavators'. Zammit (1929a, 52–56) a key figure in all work concerning Maltese antiquities, did some work retrieving clay figures of human form at the Mnajdra site. From then on, there was little or no archaeological work done on the site until after the Second world War, when the National Museum at the beginning of the 1950's undertook major cleaning, tidying and restoration work of the monument; this led to the excavation survey of 1954 with the purpose of establishing the chronology of the various buildings on the site, (as reported in Evans' publication, *The Prehistoric Antiquities of the Maltese Islands* (Evans 1971, 103–103)). Trump (1972) who has published numerous articles and books on Mediterranean prehistory and has conducted several excavations on Maltese megaliths in the 1950's assisted Evans in his excavation work.

Archaeological Chronology

Firstly one should emphasise that the chronology of Mnajdra is, according to Grima, 'on shaky ground' (Lomsdalen 2014, 209). Its construction chronology is mostly based on typological observations rather than stratigraphic trench excavations (e.g. Evans (1971, 102). The first person to have considered chronology was Fergusson (1872, 41) who maintained that the middle, or North temple, was the earliest due to its simple architecture and the fact that it was placed on higher ground than the other two. Mayr (1901, 663) agreed with Fergusson that the Mnajdra complex was not constructed with a single architectural layout, but instead claimed the lower building, the South temple, to be the oldest.

Ashby (1913, 93) agreed with Mayr that the North temple is younger than the South temple as the foundation of the former piles up against the northern external wall of the latter and is thus structurally supported by the South temple. This strong argument is fully in accord with Evans (1971, 102–103) who stated that the North temple was clearly added later in the Tarxien phase, constructed all at once and not subsequently altered. Evans dug only a single trench in room 7 of the North temple, where a large number of pottery shards, all of advanced Tarxien type, were recovered. This indicates that the temple was being used during the Tarxien Phase and, since no pottery from previous phases was found, suggests that it would have been built in the same period. That the North temple is the most recent and that it was built and used in the Tarxien Phase thus agrees with archaeological observations since the beginning of the 20th Century; as Evans (1971, 102) claims, 'It is so evidently homogeneous throughout that one cannot doubt that it was all constructed at once and not subsequently altered.'

The small trefoil temple is not featured in these chronological debates until well into the 20th century, after Ashby (1913, 91) re-erected the western temple's fallen pitted central pillar and reconstructed part of the temple wall (Ashby *et al.* 1913). Extensive restoration work was also completed by the Museum department in 1952 and 1953 (Pace 2004b, 129). According to Evans (1971, 101) as the monument stands today, it gives an impression of a

trefoil temple, but it might have originally consisted of two pairs of apsidal rooms, of which the front has completely disappeared. The whole area around the trefoil temple seems to be part of a non-standard building layout with an irregular collection of rooms for which an overall plan is difficult to establish. Nevertheless, Evans (1971, 103) suggests that the small trefoil temple was the earliest to be constructed; this point is generally acknowledged by scholars today (Trump 2002, 148). Evans retrieved Ggantija-type pottery from a trench excavated in front of this temple (1971, 103). However, it must be noted that this does not constitute clear evidence that the trefoil temple was the first to be built. Shards from the earlier Zebbug and Mgarr periods (4,000–3,600 BCE), in addition to Ggantija pottery, were found in the vicinity of room 3 of the South temple which, following the same reasoning, would suggest an even earlier building stage for this temple (Evans 1971, 102).

The most complex temple for which to assess the chronology is the lower South temple as it shows sign of more than one building phase (Evans 1971, 102). However, on a site visit on 05 May 2013, Trump (2013) in personal communication suggests the whole South Temple to have been completed within one building stage, except for room 3 and room 5. Mayr (1901, 663) claims that 'the south building is the most important and so the oldest' (translated from German by the present author). Pottery shards from the Neolithic Zebbug (4,100–3,800 BCE) up to the Bronze Age Borg in-Nadur (1,400–800 BCE) phase periods have been retrieved there (Evans 1971, 102). According to this author, this does not necessarily mean that the temple was constructed during the Zebbug phase, nor that it was completed about 2,500 years later in the Borg in-Nadur phase. The earlier pottery might indicate that the site was used as a dwelling or religious site prior to the temple's construction, much like the 'shrine' at Skorba from the Red Skorba phase (4,400–4,100 BCE). This was in use as a sacred hut within a village compound prior to the erection of the temple itself (Trump 1966, 50–1). The later Bronze Age pottery suggests that the site was still in use, or reused, in this period. No bronze materials have ever been found at Mnajdra and there are no indications of metal items being applied or implemented in the temple construction; this suggests that the temple was completed before the Bronze Age. According to Pace (2004b, 129) 'the current version of the Lower Mnajdra was built during the Ggantija phase'. Evans (1971, 103) on the other hand estimates, 'Space 1 seems to have been made in its present form at the very beginning of the Tarxien phase'.

There is evidence that the South temple was not built all at once but in phases or that, at least, changes were made throughout its usage history. According to Evans (1971, 102), Fergusson had already noticed that an apse had previously been altered to make space for room 3 with its niches (Fig. 6.3). Mayr (1901, 663) agrees with Fergusson on this point and further suggests that the back central room (room 2) with its original two apses (3 and 4) are the remains of an earlier structure. Room 3 would not only have been refurbished later but, due to similarity of style and the presence of the same drilled and pitted decoration, this would have occurred at the same time that the front apse (room 1) was added on. Ashby largely agrees with Mayr's claims, but suggests that the back wall of the rear and left-hand apse (room 3, β and y) still stood and formed the back wall of the rear left-hand niche (Ashby *et al*. 1913, 97). Based on this, it may be argued that room 3 could belong to the very earliest part of the temple. During Evans' 1954 campaign he dug a total of ten trenches in various parts of the lower temple and according to his account, 'with varying successes' (Evans 1971, 102). He claims to have cut an important trench in front of the threshold of

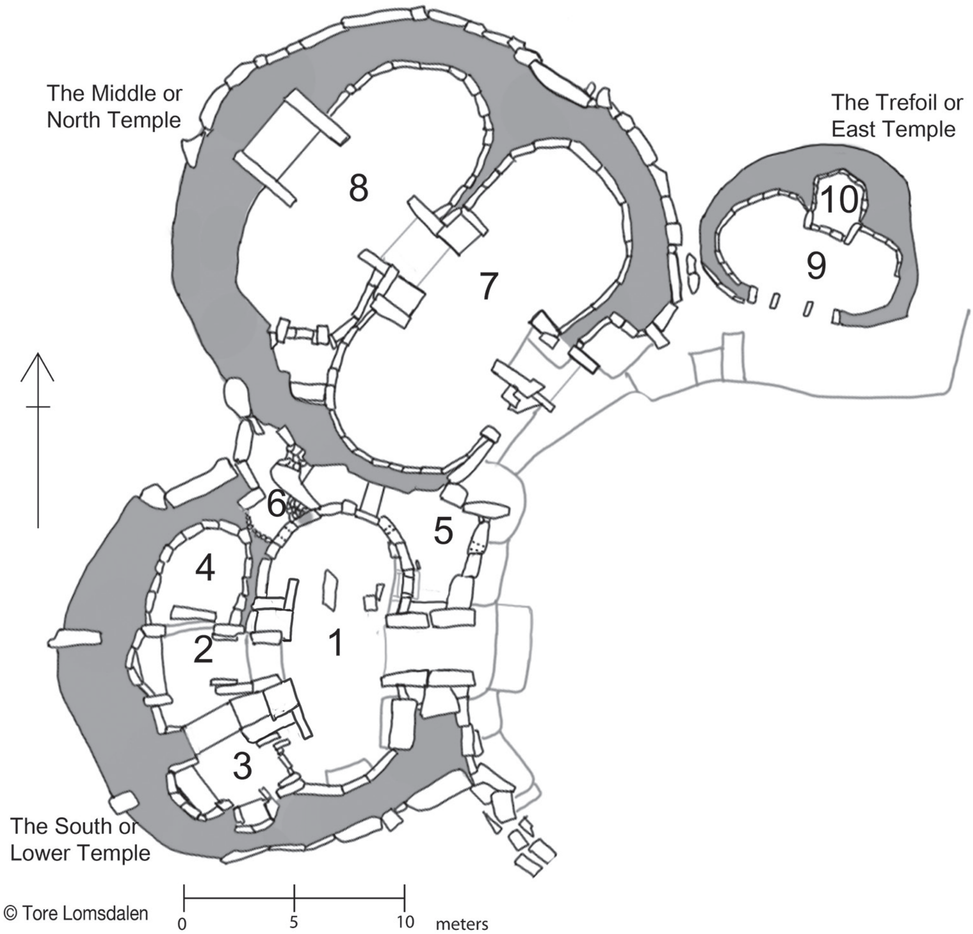

Fig. 6.3: Plan of the Mnajdra temple complex. By T. Lomsdalen.

room 3 running to the south wall of room 1 which contained a mixture of shards, some of the Ggantija type and others appeared to belong to an underdeveloped stage of the Tarxien period (Evans 1971, 102). He further suggests that the front apse (room 1) was constructed in an early Tarxien phase and that rooms 2 and 3 are probably the oldest part; ‘though now, unfortunately, unprovable,’ he concludes that the presence of Ggantija type pottery ‘seems to show that there was a building on the site in the previous phase’ (1971, 103).

Pace (2004b, 131) claims that the L-shaped room 5 is from the Tarxien period, that the room was fashioned out of the wall of lower Mnajdra and that megaliths from the older building were used to structurally support the middle temple. This paper’s author observes that the wall that separates room 5 from room 1 appears to be a dressed outer wall of room 1 following the curves of the wall itself. If the builders’ intention was to have the apse wall as part of an area filled with earth, it may be assumed that less labour would have been put

into aesthetic work on that side of the wall; thus, the south temple gives no impression of being a supporting foundation for the middle temple (Fig. 6.4).

Evans (1971) on the other hand, does not mention any possible refashioning of the wall of room 5. Evans (1971, 102) cut two trenches (E and F) in room 5; both contained Tarxien type pottery, whereas in one of them (E) Ggantija potsherds were found at a deeper, black level. This author suggests that as: i) room 1 was built sometime in the Gganija period; ii) the Ggantija pottery was found in room 5 close to the outer wall of room 1; and iii) the room itself is most probably from the Tarxien period (as stated by Pace) this could indicate that the Ggantija pottery was there before the floor of room 5 – and consequently the façade wall – was constructed. Evans (1971, 103) further suggests, due to the presence of Ggantija pottery in the black level in trench E that there was a 'building on this site in the previous phase'. The question of the construction of the L-shaped room 5 may be relevant to when and how the front façade of the south temple was constructed.

To investigate the chronology of the South Temple's building stages, a closer inspection of the main entrance was conducted in December 2012 to search for signs of its having been extended. The shaft of the entrance is about 3 metres long, 1.8 metres wide and about 2 metres high. At about 1.9 metres from the outside are clear visible signs of a constructional split in both the threshold and side panels (Fig. 6.5). The outer vertical slabs are 1.9 metres long and 65–70 cm wide and consist of the harder Coralline limestone (Grima has suggested that they might even be the hardest of all the limestone, the Lower Coralline on which Mnajdra is built); the inner walls are 1.1 metres long and 25–30 cm wide and the softer Globigerina limestone has been used of which the apses in room 1 have also been constructed. These observations give the impression of a second phase extension of the entrance towards the forecourt, and that the inner part may have been the original entrance to room 1, before the concave facade was erected, nevertheless closer archaeological examination should be undertaken to evaluate such an allegation. The rear part (room 8) of the North Temple might have been constructed during the same time period or shortly after, all in an early Tarxien phase. This author has been unable to find any archaeological documentation which would prove or refute this construction theory. Due to the uncertainty, a guided and comprehensive analysis of the excavation data is needed before any conclusions can be drawn.

Although the precise dating of the Mnajdra building is not free of difficulties (Pace 2004b, 128), the excavations, reports and opinions of the archaeologists referred to above suggest the following chronology for the construction of the Mnajdra complex:

1. The small trefoil temple was probably built in the Ggantija period as suggested by Evans;
2. Rooms 2, 3 and 4 of the South temple were built at some point in the Ggantija period (it is unknown whether this occurred before, during or after the small trefoil temple was constructed);
3. The apses of room 1 may have been completed in later Ggantija or early Tarxien period and room 3 may also have been refurbished at that time. Room 6, however, could have been constructed in the first stage, and room 5 in a later stage, concurrent with the building of the North temple in the Tarxien period, contemporaneous with the concave façade of the South temple;
4. The North temple was completed sometime into the Tarxien period.

Archaeoastronomy and Building Chronology

As the Mnajdra complex architecture stands today, it is primarily the South temple with its eastern orientation which has attracted most astronomical interest and speculation on whether it was intentionally constructed to face celestial bodies, especially the equinox, winter and summer solstice sunrises (Fodera Serio *et al*. 1992). Since the 1980's scholars, authors and enthusiasts have addressed the possibility that the temple was intentionally built as a calendar (Micallef 1990), an astronomical observatory (Micallef 2000, 3) or a device to keep track of the timing of religious festivals and other events throughout the year (Cox and Lomsdalen 2010; Lomsdalen 2011). Astronomical alignments of the North temple have been investigated by Vassallo (2000) and Albrecht (2004, 50–59). However, more extensive investigations were conducted by Ventura *et al*. (1993) regarding the two tally stones centrally placed in the small trefoil temple, which may have been used as a calendar to mark the heliacal rising of the Pleiades and other stars and asterisms, registering significant astronomical sequences of annually occurring events. An astronomical factor that must be kept in mind when comparing alignments towards celestial bodies in the Temple Period and today is that the stars have changed positions due to precession, and due to changes in the tilt of the Earth's axis, the Sun rise and set horizon range was about 3/4 of a degree further north and south than it is today (Agius and Ventura 1980, 16).

The small trefoil temple

As this temple stands today it has a central axis of about 210°; however, due to heavy reconstruction and refurbishment, it is dubious whether this azimuth accurately reflects its original axis. It is too wide for a true south alignment, but could indicate an orientation towards the small islet of Filfla, which can be seen from within the main apsis of this temple at about 220°. That Filfla probably was a sacred island is indicated by the finds of pottery, jars, bones of animals and a possible sailor's 'shrine' belonging to Temple Period (Farrugia Randon 2006, 43). In 1343 a chapel dedicated to the Assumption of Our Lady was erected after a fierce storm that caused much damage on the mainland (Farrugia Randon 2006, 41). During a 2011 survey conducted by this author and Dr. Fabio Silva, it was found that one of the chambers of the nearby temple Hagar Qim is also oriented towards Filfla, a fact also noted by Tilley (2004, 130).

Assuming that the tally marks previously mentioned are from the Temple Period, this further indicates an awareness of heavenly events and their importance to human actions and behaviour on Earth. Further evidence comes from what is tentatively called a 'solar wheel': a small pottery shard retrieved at nearby Hagar Qim (Ventura 2004, 312). Another example may be the tal-Qadi Stone found at the temple site of the same name, suggesting stars and a crescent moon (Micallef 2001). The orientation of the small trefoil temple may probably be seen more as a cosmological orientation than an astronomical one. England (2004, 413) claims that the altar-like shape or bulls' horns profile of the islet attracted the attention of the temple builders and acted as a pivotal horizon point where sea, land and heavens meet, and further to Grima, (2001, 56) all important components in an islanders' cosmology.

The middle, or North, temple

The middle temple is oriented towards south-east, with a central axis of about 140°, which

Fig. 6.4: Room 5 seen from the east-north corner indicating an outer dressed wall of room 1, the oracle hole, a porthole entrance with rope holes and a clear distance between the south and the middle temple. Between the two temple walls are the remains of a collapsed niche or an altar. (Photo T. Lomsdalen).

Fig. 6.5: Visible signs of a constructional split in both the threshold and the wall panelling about 2/3 inside the main entrance of the south temple. (Photo T. Lomsdalen).

could indicate that the builders intended to align it halfway between the central axis of the trefoil temple (210°) and the lower temple (92°). As stated above, there are many indications that the middle temple is the last to be constructed and belongs to the Tarxien phase. Evans (1971, 102) claims that this temple was constructed all at once, based on its thoroughly homogeneous architecture. Nevertheless, it is here suggested that it could have been built in two stages: the first consisting of the back apses (room 8), which was subsequently extended at a later stage. This was a procedure that was commonly used by the temple builders (Evans 1959, 125–6). Room 8 has two altars, a small one at the left-hand apse reachable through a porthole entrance in the temple wall with a central axis about 0° (true north) which is confirmed by Albrecht (2007, 29). The other, apparently the main altar, is the back niche of room 8. Standing at the south edge of this altar, two orientations were measured through the one-metre wide entrance (Fig. 6.3). Following an imaginary line through the north side of the entrance gives an azimuth of about 118° (declination of -22.4°). Following a line through the south side of the entrance gives an azimuth of about 126° (declination -29.1°). These azimuths indicate that winter solstice sunrise would be framed by the temple's entrance, as seen from the niche in room 8. In the same way, the major lunar standstill moonrise would be seen to rise close to the south side of this entrance. Cox (2009) made observations of the 'Far-Southerly Moonrise' of three Maltese temples from 2005 to 2007 but did not include Mnajdra in his research programme; however, in private correspondence with Cox in 2010, this possibility was proposed and was investigated as just explained. Consequently, the present author's hypothesis cannot be observed and validated before around the years 2023 to 2025 when the far-southerly moonrise will again be visible. However, cross-jamb illumination of an altar seems to have been a commonly desired feature used by the temple builders (Cox and Lomsdalen 2010). According to research by Vasallo (2007), a left-hand cross-jamb illumination of demarcated areas inside the temples at winter solstice sunrise seems to be prevalent in megalithic Malta: a total of twenty-one out of twenty-four (or 88%) investigated sites show an alignment with the winter solstice sunrise.

When the temple was extended with the front apses, it would consequently block the illumination of the back altar, especially if the temple was roofed (Trump 2002, 150). With the new apses, the major lunar standstill alignment continues through the north side of the 1.25 by 1.60 metre wide main porthole entrance to room 7 (now partly destroyed). On either side of the entrance to the passage leading from room 7 to room 8 there are the usual altar-like arrangements (Evans 1971, 99). The present author can confirm that, at winter solstice sunrise, the altar on the left-hand side of the passage is illuminated (Fig. 6.4), a fact already noted by Vassallo (2000) and Albrecht (2007, 26). Based on archaeoastronomical considerations, it may be suggested that the builders started with the back apses and at a later period extended the temple. In doing so, they would have intentionally kept the original astronomical alignments towards the sun and the moon intact, which would certainly suggest intentionality of directionality.

The lower, or South, temple

Most literature on astronomical alignments regarding the South temple seems to assume that the building was constructed all at once and only takes its present architecture and layout into consideration. There are archaeological indications, as previously mentioned, that this temple might have been expanded from the rear apses outwards. The question is which part

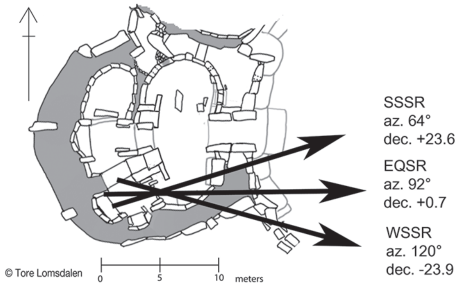

Fig. 6.6: Room 3 of Mnajdra South. The three arrows indicate alignments to the Summer Solstice sunrise (SSSR), Equinoctial sunrise (EQSR) and Winter Solstice sunrise (WSSR), measured by the author in situ.

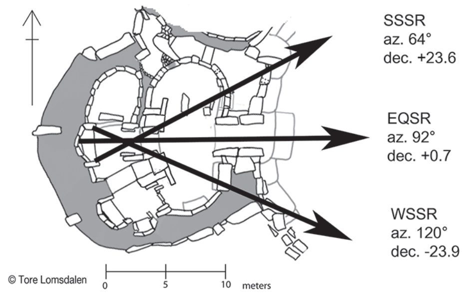

Fig. 6.7: Equinoctial and solstitial alignments in room 2 of the south temple, measured by the author in situ.

of the back apse was the very first to be erected. This paper argues that room 3 might have been the first freestanding structure and the rest of the temple consequently was expanded from there. This hypothesis finds archaeological support from the trenches excavated by Evans, as discussed above. Furthermore, Ashby suggests that the back walls of the niches of this room are original and not refurbished. From this author's point of view, this structure has all the elements of a free-standing Maltese prehistoric temple in its own right: it has its own porthole entrance with rope holes for door closure, three niches, dressed altar stones for ritual purposes and receives cross-jamb illumination during sunrise at the Solstices.

Astronomically, room 3 has alignments to the equinox (EQSR), the winter (WSSR) and summer solstice sunrise (SSSR), during which specific areas inside would be illuminated (Fig. 6.6). These alignments are not as precise and demarcated as later parts of the South temple and may indicate an earlier period of horizon astronomy knowledge. The extension of this temple might have first been towards room 2 and 4. Astronomically room 4 seems to be of little interest; however, room 2 is highly central to the temple's overall axis of about 92° (declination +0.7°) which aligns with the spring and autumn equinoxes, fully illuminating the altar at its back niche (Campion and Malville 2011, Lomsdalen 2011). However, Ventura *et al*. (1992, 118) suggest the temple might have been aligned to the rising of the Pleiades and not the equinoctial sunrise. The altar of room 2 is also aligned to both summer and winter solstice and would receive cross-jamb illumination from both the summer and winter solstice if room 1 was not yet constructed (Fig. 6.7).

Room 1 is similar to the later built room 7 in which there is an altar on each side of the passage into the back room. At summer and winter solstice sunrise, the two altars in room 1 would receive a cross-jamb illumination before the extension of the main entrance and the building of the concave façade, as previously mentioned (Fig. 6.8). This is also when the rear part (room 8) of the North temple might have been constructed.

With the building of room 5, completion of the North temple (room 7), setting up the concave façade of the South temple and elongating and narrowing its main entrance, the two altars just mentioned would be closed off from sunlight at time of the solstice (Fig 6.9). It is here suggested that this was when the two vertical orthostats were placed on each side of

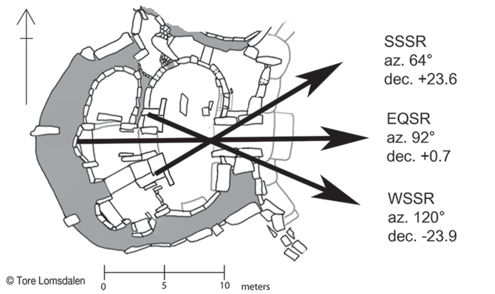

Fig. 6.8: Equinoctial and solstitial alignments from the two altars in room 1 through the first building stage of the main entrance of south temple, measured by the author in situ.

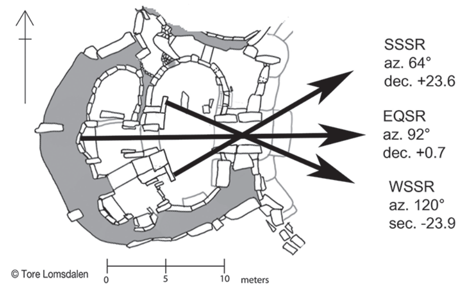

Fig. 6.9: Equinoctial and solstitial alignments of the central corridor and from the two vertical orthostats as being observed today in a cross-jamb illumination, measured by the author in situ.

the altars in order to receive the cross-jamb illumination at the summer and winter solstices that can be observed today (Lomsdalen 2011).

Contrary to this author's suggestion, Pace (2004b, 131) maintains that room 5 was 'fashioned out of the wall of the Lower Mnajdra' with the former external megaliths of the older building used as the supporting wall of the middle temple. This would then have been done in the Tarxien Phase. By this it seems Pace assumes that the south temple was completed before the builders started to erect the middle temple. On the other hand, this paper's hypothesis is sustained by Evans' (1971, 103) findings of pre-Tarxien types of pottery under the floor of room 5, and his suggestion that there was a building on this site in the previous Ggantija Phase. Based on Evans' indications this may suggest that this area was not filled with wall packing before room 5 was built and consequently could have been created through extension of the façade.

Based on the above-mentioned hypothesis, the suggested chronology may be visualised in the following sequence:

Conclusion

The research question behind this paper was to investigate whether archaeoastronomical features embedded in individual rooms and sections of the Mnajdra complex can support and further the hypotheses of archaeologists regarding the chronology and building sequence of the three temples. As the architecture of the temple stands today, solar alignments at equinox and solstices do seem to be an integral purpose of the structure and may have been a means of calibrating time and seasons for particular earthly events influenced by celestial events. Whether this was an intention of the temple builders cannot be proved; it should not, however, be disregarded. Therefore, in search of architectural intentionality based on positions of heavenly bodies and especially the sun's movements along the eastern horizon of Mnajdra, a redefined chronology has been researched. The reason for this is to investigate whether a continuous consideration of the sun's position in relation to the temple structure throughout the various building sequences may be expected. Evidence for such a purpose

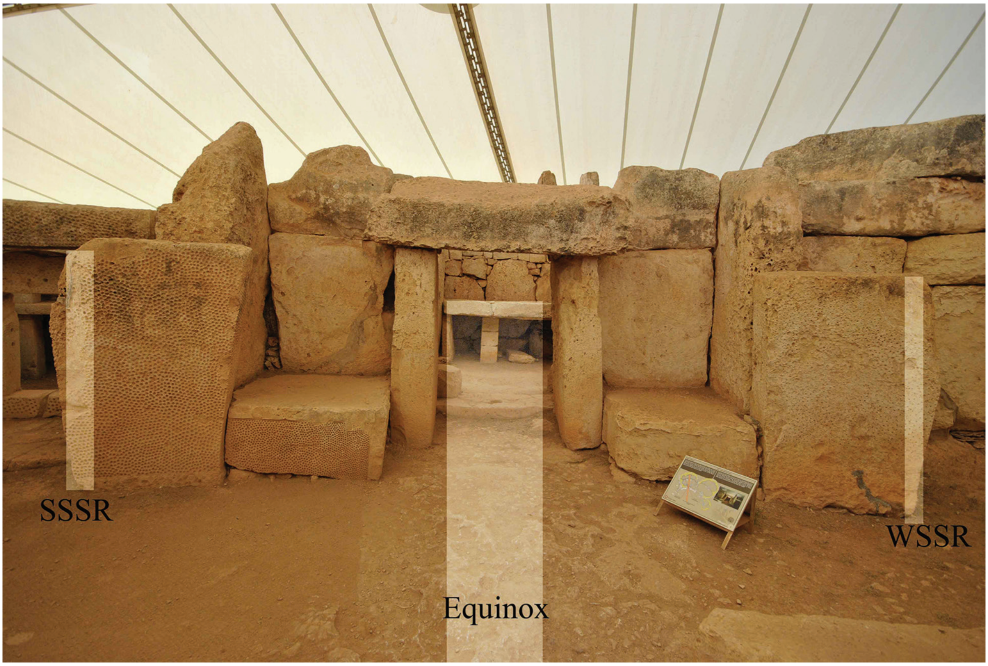

Fig. 6.10: A slit image indicating equinoctial and solstitial (SSSR, WSSR) sunrise illumination in the South Temple. (see Fig. 6.9). (Photo Lomsdalen).

would strengthen arguments for determination and intent as celestial alignments may have been a core element within an overall master plan carried out over a period of about a millennium and a half for the creation of a sacred site for religious worship, paying respect and obeisance to the power of cosmos. Based on this the following redefined constructional chronology has been proposed:

1. Mnajdra East might have been the first to be constructed, in the early Ggantija Phase (3,600–3,000 BCE). This idea is rooted in typological and archaeological considerations; unfortunately, archaeoastronomy can add little.
2. Mnajdra North could have been built in two separate stages, one in the middle and the other in the late Tarxien Phase (3,000–2,500 BCE). Based on archaeoastronomical observations, its construction could have started with the back apses and later been expanded by adding a new room to the temple.
3. The complex Mnajdra South may have been constructed in four stages:
   a. Room 3 dates from the early Ggantija Phase and could be contemporary with, even older than, Mnajdra East. It contains several characteristics of a temple in its own right, including the solstitial and equinoctial illumination patterns displayed by the final version of the South temple.
   b. Rooms 2 and 4 could then have been added in the middle Ggantija Phase. Room 2 again replicates the same archaeoastronomical signature now in its final form (with the central axis oriented towards the East).

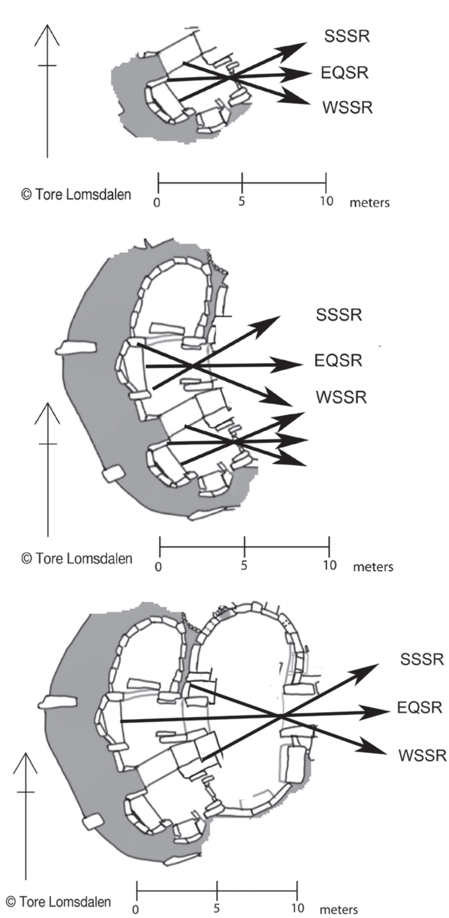

Fig. 6.11: The suggested first three building stages of the south temple. On the left: room 3; centre: adding rooms 2 and 4; on the right: the extension of room 1, all with alignments towards EQSR, SSSR and WSSR.

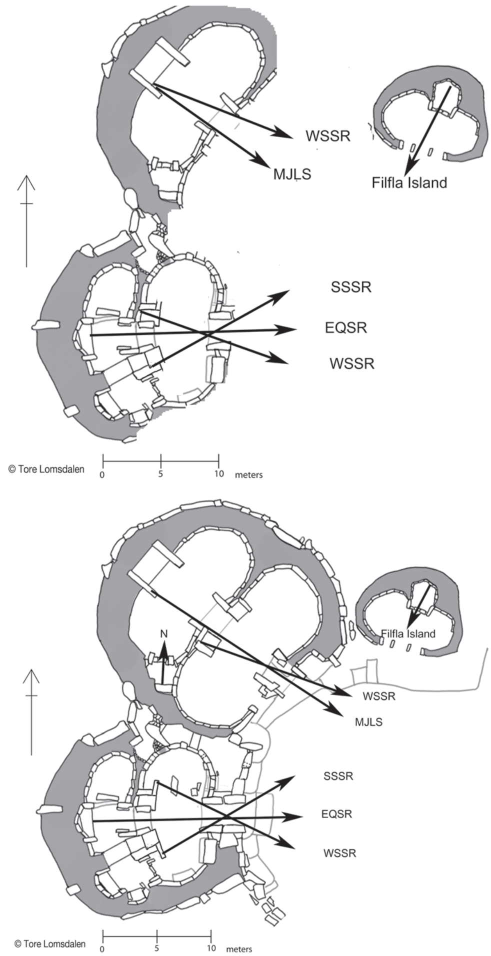

Fig. 6.12: On the left: the suggested fourth building stage adding room 8 of the middle to the south temple. On the right: the completion of the Mnajdra complex as it presents itself today, with alignments.

c. Extending the temple with the front apses (room 1) seems to have been the third building stage and may have been completed sometime in the late Ggantija or early Tarxien phases.
d. The fourth and final stage may have been the erection of room 5 as a foundation support for the room 7 extension of Mnajdra North. To maintain architectural uniformity the entrance to the south temple was then elongated and its present concave façade established. In doing this, fifteen hundred years of off-and-on building was concluded, already well into the Tarxien Phase.

It is questionable whether astronomical alignments and orientations towards celestial bodies can provide precise dating evidence. Nevertheless, archaeoastronomy may provide data that supplements the archaeological evidence and thus aid in the formulation and testing of hypotheses.

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7

Star phases: the Naked-eye Astronomy of the Old Kingdom Pyramid Texts

Bernadette Brady

Investigations by archaeoastronomers into the pyramids of the 4th Dynasty of the Old Kingdom in Egypt have focused their attention on the orientation of the structures, the alignments of internal shafts towards the heavens and/or the potential or lack of potential for the constellations to be described in the landscape by the locations of pyramids (Magli and Belmonte, 2009,307). Giulio Magli (2009, 78, 96) juxtaposes his findings with claims made by Otto Neugebauer and Richard Parker who concluded that Egyptians of the third millennia had no or little astronomy based on the lack of astronomical diagrams on ceilings or other such documentation. Neugebauer's and Parker's conclusion is, however, no longer accepted. Magli and Juan Antonio Belmonte (2009, 307) claim that such knowledge is revealed in the structural elements of the pyramids and that the 'Egyptian planners, including those of the 4th Dynasty pyramids would have been skilled skywatchers.' These structural elements include the precision of the faces of the pyramid of Khufu to indicate the cardinal points with an accuracy of 3 minutes of arc (Spence 2000, 320–1). Such precision would, as Magli and Belmonte (2009, 307) put it, require 'repeated and precise observations of either setting, rising or meridian transit of relatively bright stars.' An additional element is the general acceptance of both Egyptologists and astronomers that the so called 'air shafts' within the Great Pyramid are symbolically oriented towards certain stars (Krupp 1983,102–105; Edwards 1993, 284–285). These shafts, according to Magli and Belmonte (2009, 312) point to Sirius and a part of Orion's belt, as well as some circumpolar stars.

Magli and Belmonte (2009, 307) summarise all this evidence by claiming that the 4th Dynasty pyramids at Giza are 'architectural objects in which astronomy could be considered as *built in* [their italics].' However, with a nod to Neugebauer and Parker, Magli (2009, 96) in 2009 lamented that such great structures with their '*built in'* astronomy were lacking the astronomical documents found in the period of the Middle Kingdom, such as the great ceiling of Semut, described by Donald Etz (1997, 143) as being the earliest example of an Egyptian celestial diagram. However, evidence of Egyptian astronomical knowledge of the third millennia is not confined to the 4th Dynasty pyramids. I argue that the pyramids of the later 5th and 6th Dynasties which have Pyramid Texts are also filled with astronomical intent. These pyramids are smaller and in ruins, nevertheless, even though their construction appears to be of an inferior quality, they reveal a shift in the role of astronomy in Egyptian

beliefs as these later structures use the written word as their gateway to celestial connections rather than trusting solely upon the efficacy of precise architecture.

The Pyramid Texts have been found in ten tombs in Saqqara, the necropolis of the Old Kingdom capital, Memphis. They are poetic, mythical, and religious in nature and, as Mercer (1956, 9–10) notes, deal with the journey of the deceased king and his ability to be released from the earthly bonds of the Netherworld to join the eternal 'Imperishable Stars'. However, Raymond Faulkner (1969, v) commented in his translation of these texts, that although the texts are complete and *in situ*, they pose considerable problems for any translator as their mythological intent is obscure. In considering the text focused on the actual ascent of the king one utterance, translated by Faulkner (1969), stated 'The King stands on the eastern side of the celestial vault, there is brought to him a way of ascent to the sky…' (§326), while another utterance stated that when the king has reached the east he then rises in the evening sky like a great bird:

> O King, free course is given to you by Horus,
> you flash as the Lone Star in the midst of the sky,
> you have grown wings as a great-breasted falcon,
> as a hawk seen in the evening traversing the sky.'
> (§1048–1049).

Faulkner (1966, 160–1) struggled to make sense of the references in the Pyramid Texts to a 'Lone Star' which rose at sunset and then proceeded to act like a circumpolar star. He reluctantly fell back on suggesting that this must be a bright Venus setting in the evening and that the references in the texts to the star rising in the east were all scribal errors. Thus the texts are generally assumed to be purely religious in nature and focused on the Egyptian belief of the divine nature of their king. Seen in this light they are not considered to contain astronomical material of merit.

Faulkner's confusion concerning the actual manner of the movement of the stars is in fact endemic within contemporary scholarship. This is evident in Clive Ruggles' (2005, 180) description of the movement of the stars:

> For any given place and any given star (apart from circumpolar ones), there will be a time of year, typically lasting a few weeks, when that star is not visible in the night sky at all, because it is rising at approximately the same time as the sun and setting at about the same time as the sun.

This is not, however, a complete description of how the stars move. Simple observation reveals that there is a group of stars which are *not* circumpolar yet are *never* totally removed from the night sky. Ruggles' view has, in fact, been one that has been tralatitiously perpetuated, that is to say it has been passed from one scholar to another without reference to the primary source, in this case the sky itself.

This paper seeks to address this basic misunderstanding around star movements and then argues that the stellar precision reflected in the architecture of the 4th Dynasty pyramids of Giza developed or was expressed as a text-based stellar theology in the 5th and 6th Dynasties pyramids at Saqqara. Thus the astronomical vehicle used for the ascent of the king's soul changed from architecture in the 4th Dynasty to the power of the written word in the 5th and 6th Dynasties. In this way both are expressions of the precise sky watching skills evident in the structures of the 4th Dynasty – one, is text which is born from the knowledge of the other, buildings.

How the Stars Move

Observation of any starry sky quickly reveals to the observer that the entire sky is rotating around a fixed point, the celestial pole. For an observer in Giza (latitude 29º 58' 45" north and longitude 31º 08' 03" east) the whole starry vault will rotate at a point due north at an elevation above the horizon of 29º 58' 45", matching the latitude of the observer. This circular motion tends to divide the sky into natural zones. The closer a star is to the pole, the smaller the circle it will transcribe in the night sky. Some stars will describe a circle small enough that they will never been seen to touch the line of the horizon. These stars are defined as circumpolar stars. Other stars transcribe larger circles which cut the line of the horizon and hence appear to rise and set. The actual size of these circles (the declination it describes) when combined with the movement of the sun along the ecliptic and the local horizon, produces the phenomena described by the second century astronomy and geographer Claudius Ptolemy (see 1993) as the star phases. Elsewhere (Brady 2012) I have discussed these phases, however a more detailed description is required here.

For an observer at any sub-polar latitude there are three ways that a star can be seen to move in the night sky. A star can be circumpolar, as just described. Another group of stars behaves as Ruggles' described in that at some time during the year they are seen to rise or set during the night while at other times they will not be visible at any stage during the night from sunset to the following sunrise. The length of a star's time of invisibility will vary from a few weeks to a few months, depending on the star's location on the celestial sphere in relation to the observer. Ptolemy (1993, 5) labelled this group of stars as moving through the phase type of Arising and Laying Hidden (ALH). But these two movements do not fully describe the stars. Some stars, upon being observed to set just after sunset do not begin a period of disappearing from the night sky, as is the case with a star subject to the ALH phase, instead they will be observed to rise later that *very* night. Comparing the two movements, a star which exhibit the ALH phase has a time of the year when it is visible and a time of the year when it is not. In contrast a star of this other group has, a time of the year when it will set and rise in the *same* night and then have a time of the year when it will appear to act as a circumpolar star. Ptolemy (1993, 5–6) defined this type of star as belonging to the phase of Curtailed Passage (CP). There is of course a fourth group of stars which never rise at all and thus are never observed for a particular latitude. These star phases, without any respect to the problems of observation, are summarised in Table 7.1.

If the rising and settings of stars are used solely for calendrical purposes then an understanding of the intricacy of their annual sky-narrative – phase type – is not required. Bernard Goldstein and Alan Bowen (1983, 331) note that from the period of Hesiod to the time of Eudoxus (*c*. 408–347 BCE,) Greek astronomy was focused on the construction of star calendars, thus the Greeks had little need of star phases. Hesiod, in the seventh century B.C.E., simply used the stars to create, or record, a practical calendar as this example from his *Works and Days* (2006, 13) shows:

> When the Pleiades, daughters of Atlas, are rising, begin your harvest, and your ploughing when they are going to set. Forty nights and days they are hidden and appear again as the year moves around, when first you sharpen your sickle.

This observation of the Pleiades disappearing for a time then reappearing in the night sky, describes what later Ptolemy defined as the phase of Arising and Laying Hidden. Another

Table 7.1: The different star phases for an observer at any sub-polar latitude.

	Group 1	Group 2	Group 3	Group 4
Ptolemy's Star Phase Type	**Circumpolar**	**Curtailed Passage**	**Arising and Laying Hidden**	**Never rises**
Star's relationship to the observer. (The orientation of the star and the observer is based on the ecliptic not the equator.)	Star is located on the same side of the ecliptic as the observer and its declination is *greater* than the co-latitude of observer.	Star is located on the same side of the ecliptic as the observer and its declination is *less* than the co-latitude of the observer.	Star is located on the opposite side of the ecliptic to the observer and its declination is *less* than the co-latitude of the observer.	Star is located on the opposite side of the ecliptic to the observer and its declination is *greater* than the co-latitude of the observer.
Observation	**Always visible for whole night** Never seen to touch the line of the horizon – never rising or setting.	**Visible every night** Sometimes seen to set and rise during the same night while at other times it is visible at sunset and still visible the following dawn.	**Sometimes visible** Sometimes rising or setting during the night while at other times not seen at all during the whole night.	**Never Visible**

passages reads (Hesiod 2006, 18), 'When Zeus has finished sixty wintery days after the solstice, then the star Arcturus leaves the holy stream of Ocean and first rises brilliant at dusk.' Hesiod is describing an evening rising, but this particular evening rising belongs to a star which is subject to the phase of Curtailed Passage, for this horizon event marks the beginning of a 70–75 day period (for 700 BCE at a latitude of Athens) of Arcturus acting like a circumpolar star – visible for the whole night. Hesiod may have been aware of this but he did not add this description to his text. This unconcern is also seen in the work of Ptolemy, who, according to Neugebauer (1971, 506), disregarded the contents of his, now lost, Book I on star phases when he wrote his weather work in Book II. In this later work Ptolemy constructed his parapegma (star calendar) using solely morning or evening risings of stars and ignored the subsequently different movements made by those stars. This lack of distinction between the two ways that stars can rise or set during the night sky was also shown in the work of the Roman poet Ovid (43BCE–17/18 CE) who, in his didactic poem *Fasti*, treated stars which were subject to the Arising and Laying Hidden phase type in the same manner as those which undergo the phase of Curtailed Passage. In his entry for 2 February he wrote (Ovid II 75–78),

> That night someone gazing at stars will ask: "Where is
> *Lyra* today, which yesterday sparkled?"
> While searching for *Lyra*, he will note *Leo's* back
> Suddenly sunk in the limpid waters.

Ovid does not mention that if his star gazer had watched the sky a little longer then *Lyra,* would have risen just after midnight, and thus would have sparkled once again in that very night sky, for the stars of the constellation *Lyra*, for that latitude and date, belong to the phase of Curtailed Passage. However, *Leo* a constellation that would either rise and later set every night or be totally missing from the night sky when the sun was amongst its stars, was indeed rising just at sunset. Reading Ovid, therefore, creates the perception that all stars, apart from those which were circumpolar, were subject to times of invisibility.

The purpose of this preamble using the works of Hesiod and Ovid is to make the case that it is probably the reading of their use of stars which has potentially led to the development of what appears to be a blind spot in later western thinking. This blind spot – the lack of acknowledgement that the phase of Curtailed Passage actually exists – is problematic in several ways. First it leads to the widespread error that any star rising before the sun is considered to be returning to visibility and, second, this leads to the error of belief, reflected in Ruggles' statement cited earlier, that all non-circumpolar stars travel through a period of being invisible for the whole night. Another issue is that it blinds the archaeoastronomer to evidence which may be in plain view, such as will be discussed later in the nature of the documentation contained within the Pyramid Texts.

The other major problem caused by this blind spot is that the terms used for discussions of star movements are insufficient and ambiguous. This ambiguousness is the result of mixing and/or disregarding the dynamic and separate naked-eye astronomy of the two different groups of stars. For example, the term morning rising is mixed with heliacal rising, where heliacal is used to mean relating to the sun (OED 1993) this latter term often being used, without thought, for *all* stars rising at dawn. Similarly evening rising is conflated with acronychal rising where the term acronychal is from the Greek, *akronych* meaning at nightfall (OED 1993). The term acronychal itself is problematic as it appears to be used by different authors for events at either sunrise or sunset. A perusal of the literature shows that there are generally two ways of using the different terms. An author may use the term 'heliacal' when discussing a star when it is rising or setting with the sun and the term 'acronychal' to talk of a star rising or setting when it is opposite the sun. In this case the term acronychal setting would be referring to a star setting at sunrise (opposite the sun) and the term heliacal setting would be for a star setting at sunset (see for example, Ruggles 2005,180; Schaefer 1987, 19; Lockyer 1892). Alternatively another set of authors will tend to use the term 'heliacal' for a star which is rising or setting at sunrise and the term 'acronychal' if the star is rising or setting at sunset. In this case acronychal setting would be referring to a star setting at sunset and heliacal setting may refer to a star setting at sunrise (see for example, Mitton 2007; Kelley and Milone 2005, 40; Davidson 1993, 160; Narrien 1833, 10). It should be noted however the term 'heliacal setting' is an exception, with both groups of authors tending to use it for a star setting in the evening in a similar way to how the term acronychal setting could be used. Another approach to this confusion of terms is to dismiss that there is any real difference between the phases. Daryn Lehoux (2000, 12) takes this approach when he writes, 'Stars north or south of the ecliptic have some difference in the sequential order of the phases but the terminology remains the same.' On the other hand James Evans (1998, 197) suggests that the terms of 'heliacal' and 'acronychal' are inconvenient and instead uses the terms morning or evening rising and setting for a star's involvement with the horizon. Simple as Evans' solution is, unfortunately it has to ignore the difference between the two types of star phases.

To begin to acknowledge the existence of the phase of Curtailed Passage scholars first need an unambiguous set of terms for *each* of the four stages of *each* of the two phase types, eight unique terms in total. I am of the school of thought that heliacal events are those which occur at sunrise and that using the OED's view that acronychal refers to evening, acronychal events occur with sunset. With this as a starting point ambiguity can be removed by only using the terms heliacal and acronychal to apply to horizon events which mark a change in the star's relationship to the horizon. For example, the term 'heliacal rising' is used to describe a star rising before the sun which is finishing its period of invisibility while the term 'morning rising' is used to talk of a star rising just before the sun, but because it belongs to the CP phase, it is *not* finishing its period of invisibility as it never undergoes a period of invisibility. This difference is not relevant for calendar markers but if the stars, their movement, and how they engage with the horizon are a part of a theological or mythological discourse, then these differences are significant.

Working with an astrolabe shows the following dynamic patterns for a star belonging to the phase Arising and Laying Hidden (Table 7.2) and a star belonging to the phase of Curtailed Passage (Table 7.3). The tables also offer a suggestion for eight non-ambiguous terms.

The Pyramid Texts

With an awareness of these two distinct star phases we can now consider the Pyramid Texts. Samuel Mercer (1956, 4) describes the texts as being, 'remnants of much earlier literature than that of the historical period in Egyptian history.' Thus although the first Pyramid Texts are dated to the pyramid of Unis (also written as Unas), whose reign is estimated to have been from 2375–2345 BCE, in terms of their contents, they are considered to have come from an earlier period, at least from the 4th Dynasty if not considerably earlier.

According to Allen (2005, 9), at the time of the Old Kingdom the Egyptian sky consisted of a skyscape which was a reflection of their landscape: The Marsh of Rest or Offerings were located in the northern parts of the sky, The Marsh of Reeds occupied the southern sky, and the path of the sun was known as the Winding Canal. Located around these places were the stars. The Egyptians recognised three separate groups of stars, with three different sky-narratives, each defined by their relationship to these places. The Imperishable Stars, those that dwelt in The Marsh of Rest, were the circumpolar stars, and they were imperishable as they were never taken below the earth (Faulkner 1966, 156–157; Lesko 1991, 99). Joseph Bradshaw (1990, 38) refers to the holiness that the Egyptians attributed to the northern part of the sky and points out that their entire universe hung from the northern pole. Upon their death, the divine kings, not only had the right to re-join these stars but were required to do so for the cosmic health of the nation (Davis 1977, 164). Allen (2005) translates an utterance from Unis' pyramid as, 'The populace will cry out to you once the Imperishable Stars have raised you aloft' (W147). Hence, in the 5th dynasty, the observation that the circumpolar stars remained visible for the whole night throughout the whole year and thus never touched the horizon was considered to be a statement of their divine nature. These stars were immortal beings who the king was destined to join and thus rule the cosmos. As Davis (1977, 166) puts it, 'In the ascent, the King re-enters the realms of celestial divinity and is given royal authority, just as he entered the world of men and was invested with similar authority.'

Table 7.2: The annual movement of a star which belongs to the phase type of Arising and Laying Hidden.

	Observation of Phase Type: Arising and Laying Hidden	Visible or Not Visible
Acronychal setting	Star sets at sunset and begins its period of invisibility. The star is seen at sunset, low in the west and setting. After this event the star is no longer seen in the night sky over a period of days, weeks or months.	**NOT VISIBLE**
Heliacal Rising	Star rises at sunrise and ends its period of invisibility. The star is seen to rise just before the sun. Having returned to visibility the star then proceeds, over the following weeks, to rise earlier and earlier before dawn. Eventually it begins to sink in the west by the time the sun rises.	**RETURN TO VISIBLITY Seen to RISE before the sun.**
The term of 'heliacal rising' for an ALH star is, thus, unambiguous as the term 'morning rising' is used exclusively for a star of the Curtailed Passage phase (Table 7.3) which when rising before the sun it not actually returning to visibility.		
Morning Setting	Now at sunrise the star is seen to be setting. However, earlier in the night the star was seen to rise.	**VISIBLE** The star is seen to RISE in the evening and SET before the following dawn.
Evening Rising	Night after night the star rises earlier and earlier in the evening until finally it rises as the sun sets.	**VISIBLE** The star appears higher in the sky each evening but finally begins to SETS before the dawn.
	From this period the star appears higher in the sky at each sunset. Over the next few weeks or months the star is visible at sunset but sets later in the night. Eventually the star is in the western sky at sunset and sets just after sunset – its acronychal setting.	

Another set of stars were called the 'Unwearying Stars' and were located in the southern part of the sky (Allen 2005, 9). These stars travelled through the Marsh of Reeds on the Nightboat which was located in the *Duat*, the Netherworld (Allen 2005, 9). These were the stars that were observed to set at sunset (acronychal setting, see Table 7.2 and 7.4) and disappear below the earth (Darnell 2004, 442). These stars followed a perpetual pattern of entering the Netherworld and 'dying' to be cleansed and then born again, sometime later, by returning to visibility as the heliacal rising star (Table 7.2 and 7.4). They were considered unwearying because they repeated this journey of death and rebirth for eternity (Faulkner, 1966, 161). The sky-narrative of these Unwearying Stars was that they were tied to the mortal world because when they were visible they were always seen to touch the horizon by rising or setting at some time during the night (Table 7.2 and 7.4). They were thus subject to 'death' at their acronychal setting, where they descended into the Netherworld to be cleansed and later reborn when they become the heliacal rising star. This type of star movement was later defined by Ptolemy as the stars that belonged to the phase of Arising and Laying Hidden.

The third type of star movement recognised in the text is described in the ascension myth of the king. In the corridor of Pepi I's pyramid the king's cleansing journey on his way to

Table 7.3: The annual movement of a star which belongs to the phase of Curtailed Passage.

	Observation of Phase Type: Curtailed Passage	**'Circumpolar' or not 'circumpolar'**
Acronychal Rising	Star rises at sunset and begins its period of circumpolar-like behaviour. The star is seen to rise at sunset. For some days, weeks or months after this event the star is seen in the night sky at sunset and is still there by the following dawn.	**'Circumpolar' activity Star does not touch the horizon**
Heliacal Setting	Star sets at sunrise and ends its period of circumpolar-like behaviour. Over time the star appears closer to the western horizon at sunset. Eventually it is seen to be setting as the sun rises but will be back in the sky the following sunset.	**End of 'Circumpolar' activity**
Morning Rising	Now at sunset the star is observed as being high in the night sky. The star will set at some time during the night. However, every night, at sunset, it appears lower in the western sky until eventually it is seen to both set in the early evening and then rise in the morning just before the dawn.	Visible but setting early in the evening and rising before the dawn.
Evening Setting	The star continues to set early in the evening until finally it sets as the sun sets, but it will rises again before sunrise.	Set with the sun but will rising later in the evening.
The term 'evening setting' is used here for stars which belong to the CP phase for, after setting at sunset, they will be seen to rise later in the same evening. Whereas the term of 'acronychal setting' is used for a star which belongs to the ALH phases which after being seen to set at sunset will <u>not</u> be visible again in the night sky for some days, weeks or months.		
	Now slowly over some days, weeks or months the rising time of the star will move closer to sunset until eventually it is seen to rise as the sun sets – its acronychal rising . The star now begins it period of circumpolar-like activity.	

the Imperishable Stars was described as 'You shall row with the Imperishable Stars, sail with the unwearying ones, and receive the Nightboat's cargo' (P453). The king is being told that he will travel below the earth (he, too, will be seen to set in the evening) but his 'seat' on the boat is privileged for his star does not 'stay' in the Netherworld – it will in fact rise again later that night. The king's star will then repeatedly rise after sunset but one day it will rise just on sunset (acronychal rising, see Table 7.3 and 7.4). At this time the king, having received the cargo of cleansing, will be transferred to the boat of the Imperishable Stars. One utterance from Pepi II's tomb, translated by Allen, stated: 'Where Pepi Neferkare shall cross to is his stand on the eastern side of the sky, in its northern part, among the Imperishable Stars who stand at their staves and with tailed kilt on their right, and Pepi Neferkare will stand among them.' (N432).

The king's star, then, over the course of the future days, appears in the night sky at sunset and will still be visible in the sky at the following sunrise. Each night at sunset it appears higher in the sky as it 'flies up' to join the Imperishable Stars. Having ascended, the text proclaims,

Table 7.4: The star phases as per the pyramid texts of the 4th dynasty.

	Curtailed Passage	**Arising and Laying Hidden**
Star seen to be the last star seen to:	**The 'Divine' Stars**	**The Unwearying Stars**
Set at sunset	**Evening Setting** – Star defies death as after it is seen to set it rises again later that night.	**Acronychal Setting** – Star 'dies' and thus begins its journey into the Netherworld as it is no longer visible at any stage of the night.
Rise at sunrise	**Morning Rising** – Star is now seen to rise just before the morning sun. Its continual rising during the night is proof of its uniqueness as the Netherworld cannot claim it.	**Helical Rising Star** – Rebirth – Star returns to visibility after being held by the Netherworld for weeks or months.
Rise at sunset	**Acronychal Rising** – Star rises but this is the last time it is seen to touch the horizon – it has been release from *Duat.*	**Evening Rising** – Star rises but is not release from the *Duat* as it will set later that evening.
Set at sunrise	**Heliacal Setting** – Star is seen to set at sunrise. The return of the divine king to the mortal world – the first visible sign of the star's return to the *Duat* some weeks or months later.	**Morning setting** – no release from the *Duat.*

> (Unis), you shall part your place in the sky amoung the stars of the sky, for you are the lone star at Nut's shoulder. May you look upon Orisis's head as he governs the akhs, while you yourself stand far from him:you are not of them, you will not be of them. (W156).

The end of the king's sky-narrative is that eventually, one sunrise, the star will be seen to set (heliacal setting, see Table 7.3 and 7.4), and thus it returns to the earth. One utterance (W207) proclaims, 'Unis's house for the sky will not perish, Unis's seat for the earth will not end' which implies that the king may once again incarnate as a living god on the earth. Elsewhere (Brady 2012, 45) I have argued that this 'lone star' that Faulkner thought might be Venus, is possibly the star Vega, for the bright Vega only breaks its link with the earth as Sirius (Isis the king's sister) enters the Netherworld and its period of circumpolar-like activity is for the long period of 75–80 days.

However, regardless of the identity of the king's star, the Pyramid Texts are the poetic and religious renditions of naked-eye astronomy which is particularly focused on the observations of the different dynamic star phases. The Eyptians placed inside their 'astronomical' buildings the careful observations of the stars, noting and distinguishing the different sky narratives of the Imperishable Stars (circumpolar), the Unwearying Stars (those that belong to the phase of Arising and Laying Hidden) and those stars which were the most sacred of all, the ones that could defie the *Duat*, for they appeared to 'die' by setting with the sun but unlike other stars they rose out of the Netherworld that very same night and then eventually could take a leap into the heavens to join the Imperishable Stars, the stars defined by Ptolemy as belonging to the phase of Curtailed Passage. Table 7.4 sets out the star phases as described by the Pyramid Texts.

In conclusion, without an understanding of the phase of Curtailed Passage the Pyramid Texts can appear, as Faulkner noted, confusing and obscure. This lack of understanding is more than likely due to the Greek focus on star calendars and thus the phase of Curtailed Passage has, for many scholars, fallen out of memory. Notwithstanding the Greek abandonment of star phases, the theological themes they represented for the Egyptians of reincarnation and the presence of god-like humans or divine intermediaries has, however, not been lost. These themes are a deep part of the human view of the divine and for the Egyptians of the 5th and 6th Dynasties these were modeled on, and held by, the stars. Additionally by recognising that the Pyramid Texts are descriptive of star phases, then although they are written in a poetic, religious voice, they speak of the observation of the stars and their movements. These observations are reflective of what Magli and Belmonte noted with regards to the precision of the architecture of the earlier 4th Dynasty pyramids. In this way these later 5th and 6th Dynasty pyramids contain the theological legacy of the earlier Egyptian skywatchers – one in architecture, the other in text.

Finally these religious and mythical descriptions of the star phases have broader implications for archaeoastronomy. For, putting the problems of precession to one side, the phase of Curtailed Passage offers two extra points on the horizon: one where a bright star descends to the earth from the immortal circumpolar stars, and the other, the place on the horizon where it ascends to the divine. Thus, for example, any northern hemisphere structure orientated toward the north east or west can be investigated for its possible involvement with a bright star which has these 'divine' features. There is no reason to assume that the sacred nature of stars was the exclusive domain of the third millennium Egyptians.

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8

An Architectural Perspective on Structured Sacred Space – Recent Evidence from Iron Age Ireland

Frank Prendergast

> 'A society which does not believe in its survival is incapable of the symbolic representation of its aim, and therefore incapable of building'
> (Krier 1992)

Archaeological visibility of Iron Age society in Ireland has been described as enigmatic owing to the relative paucity of the material culture and settlement record for the period (Raftery 1994, 112). Becker (2009, 354) regards this period of Irish prehistory as extending from 700 BC to 400 BC (Early Iron Age), 400 BC to 1 AD (Developed Iron Age), and AD 1 to AD 400 (Late Iron Age). In contrast to the abundant record of sites and monuments available for the Neolithic and the Bronze Age periods, this comparative invisibility continues, notwithstanding the rapid growth in the rate of site discovery resulting from recent infrastructural development projects – especially the national roads programme (e.g. Mc Laughlin and Conran 2008; Taylor 2008). Moreover, an analysis of the almost 1,000 sites currently hosted on the web-based NRA Archaeological Database (http://www.nra.ie/Archaeology/) indicates that a mere 8% of those have yielded Iron Age dates (Mc Carthy 2010).

As described by O' Connell (2013, 61), the discovery in 2007 of the likely Iron Age pagan temple site at Lismullin, Co, Meath (hereinafter Lismullin 1), has yielded an 'extraordinary' and rare example of a ceremonial complex of this type. Radiocarbon dating by Marshall *et al.* (2013, 141–45) indicates that construction of the monument began in *c.* 455–400 BC (68% probability) and for it to have gone out of use in *c.* 370–330 BC (38% probability). These data thus chronologically place it at the transition of the Early and Developed Iron Ages, and suggest longevity of just a few generations for the site.

Convincing evidence for the claimed role of Lismullin 1 as a ceremonial site is contained in the meticulous archaeological excavation record (see O' Connell 2013) and in the outcomes of a range of commissioned specialist reports (*ibid.*), including geospatial analysis. From those, the absence of any evidence for human burial or habitation in the material record is interpreted as indicating a probable restricted ritual use for the complex. Significantly, the analysis of soil chemistry for variations arising from natural and cultural processes demonstrates that the buried soils are derived from local parent material and do not contain significant cultural elements that may reflect site function (Lancaster 2008). Lancaster further concludes 'It is highly unlikely that the chemical analysis of the other samples taken for this

purpose will produce data that will provide significant evidence of past cultural activities' and that such a 'chemically clean signature' is highly consistent with the reserved/controlled use of this space, unlike most archaeological sites. This makes the site anomalous when usage is assessed by conventional archaeological criteria.

Collectively, these findings support the thesis that the complex was built as a focal structure to facilitate public gathering and ceremonies, and give significant weight for its designation as a temple by O' Connell.

Lismullin 1 – A Ritual Pagan Temple?

With relevance to this discussion, and because of the uniqueness of the typology of the structure, a summary description of Lismullin 1 is warranted. Firstly, two attributes can readily explain its exclusiveness in design terms. The architectural style replicates a method of construction more typical of the Late Neolithic (*c.* 2850–2450 BC) than of the Iron Age (e.g. Gibson 2005). Secondly, the landscape setting differs profoundly from the prominent hilltop setting encountered at Irish Iron Age royal sites with which Lismullin 1 can be compared. Moreover, the complex is situated in a natural saucer-shaped depression adjacent to a river (Fig. 8.1). The large diameter of the outer enclosure, and the minimal thickness of

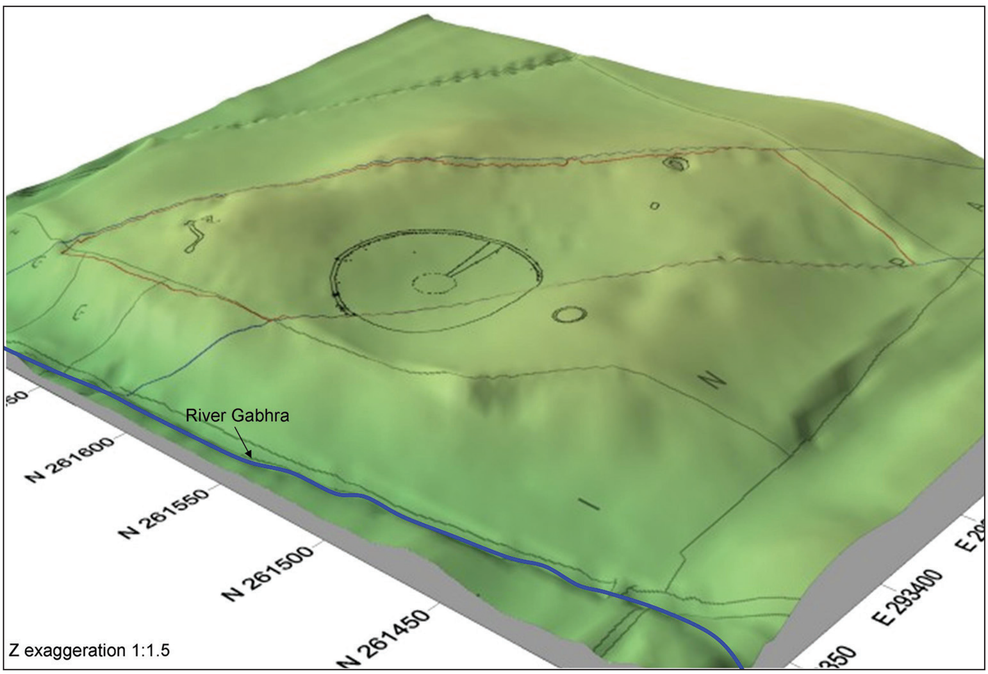

Fig. 8.1: Landscape setting of Lismullin 1. The digital elevation model is courtesy of Archer Heritage Planning. The location coordinates are expressed in metres in the Irish Grid reference system. The vertical relief is exaggerated at 1:1.5.

the timber posts inferred from the size of the recovered post-holes, suggest that the structure would have been incapable of supporting a roof. This potentially integrates the sky into the phenomenology and cosmology of the site, and how it may have been used.

Such a setting, characterised as it is by topographical discreteness, centrality within a natural surrounding ridge, openness to the sky, and proximity to flowing water, collectively contribute to its '*genius loci'* (spirit of the place) – a qualitative term used by Norberg-Schulz (1980). These ideas are explored later in the paper.

Summary spatial description

The discovery of the sub-surface traces of *c.* 590 upright wooden posts in 2007 was as a direct result of mandatory archaeological and environmental monitoring undertaken in advance of construction of the M3 motorway. When fully recorded, the patterns that emerged from the recovered post-holes delineated the following circular and linear elements (Fig. 8.2):

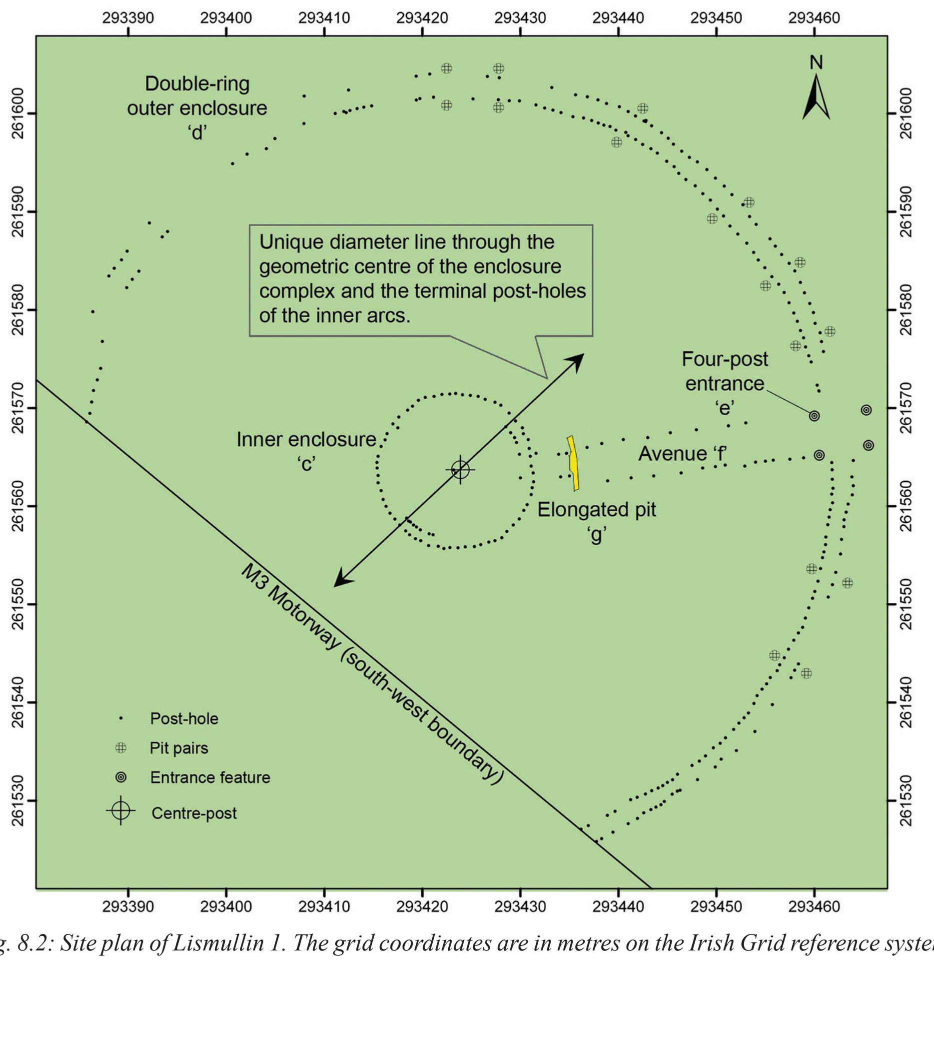

Fig. 8.2: Site plan of Lismullin 1. The grid coordinates are in metres on the Irish Grid reference system.

- Inner enclosure ring c (radius 7.97 ±0.11 m);
- Outer enclosure double ring d (radii 40.25 ±0.28 m, 38.30 ±0.28 m);
- Two short arcs of post-holes inset by *c*. 1.0 m from the inner enclosure;
- Avenue f facing east-northeast (width 3.96 ±0.13 m, outward azimuth/declination 83°.8/+5°.0, reverse azimuth/declination 263°.8/-3°.2);
- Entrance feature e articulated by four larger diameter/deeper post-holes;
- Elongated pit g set transversely to the avenue at its western terminal and offset by 4.05 ±0.20 m from c.

Quantities of charcoal, burnt animal bone and burnt hazelnut shells were recovered in the elongated pit – indicative of the use of fire and probable ceremonial/ritual deposition. Environmental assessment has indicated the presence of significant quantities of *Corylus avellana* (hazel) which could reflect the use of wattling being used as a weave between the posts made of *Fraxinus excelsior* (ash). The discovery of *Maloideae* (rose-type wood) further suggests that flower or fruit-bearing branches may have been used to decorate the structure, possibly for their aesthetic effect (see O'Connell 2013, 174).

The prevalence of high-status monuments in Ireland during the Iron Age, and the surviving corpus of prestige high-quality metalwork in the form of weaponry and horse-bits, and La Tène-style art (e.g. Raftery 1994), indicate an established sophisticated culture at that time. Although evident to the excavation archaeologists, the obvious formality embedded in the form of Lismullin 1 was consistent with the idea that the complex embodied concepts of elegant planning, proportionality and regularity. Such perceptions are consistent with its probable usage as a religious temple and for the segregation and ordered coordination of a large group of users. While such conjecture has its place in any narrative, the availability of high-quality spatial data has allowed its numerical analysis to test these claims (Prendergast 2012, 2013). The outcomes are summarised here to underpin later discussion.

Geospatial analysis

Post-holes and the outline of the elongated pit were recorded with centimetre accuracy. Thus, for the purpose of investigation of the retrospective construction methods and intentions of the builders of Lismullin 1, the extant archaeological record can be assumed to be effectively error free. Even from a mere visual inspection of the post-hole data, it is evident that the complex consists of nothing more than circles and straight lines. Such a structure could have thus been simply constructed with the rope and peg method – the likely technology of the time (Atkinson 1961, 295; 1974, 128).

The geospatial analysis investigated the following three properties:

- Structure morphology and concentricity;
- Structure metrology and proportionality;
- Archaeoastronomical properties.

The results indicate that:

- The three circles of the inner and outer enclosures were set-out from a common centre (numerically derived using the method of least squares). The residual errors between each post-hole of circle a and both circles of d, and their respective best-fit circle, support this hypothesis with a probability of 0.03, 0.05 and 0.06 respectively, at 95% confidence level. Significantly, an excavated post-hole found within 0.50 m of the

Table 8.1: Dimensions of the enclosure's elements.

Element	Mean length m	Length scaled to U for means comparison		Remarks
Radius of the inner enclosure U	7.97	-	-	Unit of measurement U
Width of avenue and entrance	3.96	0.50	X ½	Half U
Outer enclosure radius	40.25	5.05	X 5	Five U
Gaps between rings in outer enclosure	1.95	0.25	X ¼	Quarter U
Gap between internal arcs and inner enclosure	1.02	0.13	X ⅛	Eighth of U
Pitch between posts in the outer enclosure	1.04	0.13	X ⅛	Eight of U
Gap between inner enclosure and west side of elongated pit	4.05	0.51	X ½	Half of U

derived geometric centre of c is now interpreted by archaeologists (probability 0.3, at 95% confidence level) as the point that could have marked the ritual centre of the enclosure. There is additional numerical evidence from statistical analysis of pitch values that the post-holes located in the two rings of the outer enclosure were set-out in a radial manner and as a single act of construction (Prendergast 2012).

- The avenue between the elongated pit and the entrance was set-out as two parallel lines – most likely using the simple technique of offsetting the opposite side with a constant length of rope. Linear regression analysis of each avenue side for conformity to a straight line yielded correlation coefficients R^2 of 0.99 and 0.98, and parallelism within ±0.13 m (probability 0.05, at 95% confidence level) to support these claims.
- The analysis of variance (ANOVA) method provides convincing evidence that the different elements of the enclosure were constructed in a proportional manner (Table 8.1).

In the statistical comparison between the lengths of the different elements of the post enclosure shown in Table 8.1, the null hypothesis being tested is that at least two of the mean lengths are the same i.e. $m_1 = m_2 = m_3 = \ldots\ldots m_k$. The results indicate that the eight means are the same and the null hypothesis H_0 is not rejected ($p = 0.674$, $F_{crit} = 2.03$, n = 368, 95%confidence level). Adopting the width of the avenue as an alternative standard unit of measurement for this test made no significant difference to the outcome. The radius of the inner enclosure is thus argued as the most likely and pragmatic standard unit of measurement used to build the complex. By simply and successively halving this length (by folding of the rope), the width of the avenue, the gap between the inner enclosure and the pit, and the gap between the rings of the outer enclosure could have been dimensionally controlled to a high level of exactness. The outermost ring could also have been set-out using a radius length equal to five times that of the inner enclosure. Moreover, the width of the gap between the outer rings is one quarter of the radius of the inner enclosure.

The scale of Lismullin1 was most probably dictated by the diameter of the natural circular ridge within which it is centrally positioned (see Fig. 8.1). This hypothesis argues that the standard unit of measurement was merely a locally conceived design solution that optimised the fit of the complex to the available circular space enclosed by the surrounding ridge. By placing the elongated pit transversely to the axis of the avenue, it would likely have acted as a barrier to any procession i.e. of people moving from the entrance towards the presumed sacred inner enclosure at the centre. The pit is therefore interpreted as a threshold and, arguably, this may have been the most significant element of the whole complex.

- Archaeoastronomical assessment of the complex has focussed on the well defined linearity of the avenue and its axis – the invisible directional line that conceptually unites the observer, the avenue and the sky. This direction is given pre-eminence in that the avenue would have functioned as a means of formal entry and exit, as well as for procession. The avenue faces east-northeast. The azimuth and astronomical declination of its axis yielded no significant horizon-based astronomically significant events in terms of solar extremes or lunar maxima. Using planetarium software to correct the viewed night sky for the effect of precession in *c.* 400 BC, it is argued that the avenue may have been intentionally orientated so as to align upon the autumnal appearance of the Pleiades (Fig. 8.3). Such a time of year may have been significant insofar as the passage of this distinctive cluster of stars above the avenue when its altitude was *c.* 12° would have been a clearly visible and recurring seasonal phenomenon in the night-time sky – perhaps coinciding with the ending of the harvest and before the onset of winter. By about the end of October, this alignment would occur in daylight, thus ending the spectacle until its predictable return the following year. Additionally, the appearance of the rising sun or, perhaps, a rising autumnal full moon on the declination of the avenue may have acted as a temporal trigger for the commencement of any hypothetical nocturnal rituals (the azimuth and horizon altitude of the avenue's axis at Lismullin 1 indicate solar and lunar declinations of *c.* 5°.0 and 5°.8 respectively). Although occurring north of the avenue's orientation, the heliacal rising of the Pleiades in late April may also have had agricultural or ritual significance in springtime. Collectively, these phenomena strengthen the argument for the seasonal use of Lismullin1 around sowing and/or harvest periods.

This interpretation is just one of many other plausible alternatives, including the hypothesis that orientation could have been random. Critically, because of the uniqueness of the site, statistical backing cannot be offered. However, alignment on the risen Pleiades (after its apparent brightness has overcome the light-absorbing effect of the atmosphere close to the horizon, especially in northern latitudes) is consistent with the generally held view that this visually distinctive cluster was important to indigenous and prehistoric societies. It has been linked to the regulation of calendars and planting, harvesting and festival cycles (e.g. Aldhouse-Green 2010, 110; Boutsikas and Ruggles 2011; Ceci 1978; Cunliffe 2002; Kirch 2004; Oldfather 1935, 1939; Ruggles 2005).

The analysis of post-hole locations has quantified the evident formality in the design of Lismullin 1. When contextualised with the findings of the comprehensive archaeological excavation, and the related findings of the specialist reports, evidence of a relatively invisible period of Irish prehistory has improved. However, such quantitative methods do not necessarily fully explore, nor penetrate, the underlying motivations and decision making rationale behind the construction of such an enclosure. The following qualitative approaches,

while subjective and speculative, have the potential to broaden the narrative for enquiry into design intent and possible relevance to local ritual and religious practices. As Oscar Wilde stated (1891, 181) ‘An idea that is not dangerous is unworthy of being called an idea at all’.

Here, ritual is taken to mean practices associated with supernatural or religious experiences or beliefs, and as a result of material culture being deliberately situated for such purposes (Darvill 2002, 361). Darvill further adds ‘in non-westernised societies there is no formal boundary between what is ritual and secular, between the sacred and the profane’.

Social Network Analysis and Narrative Structuring

If Lismullin 1 was used as a pagan temple, then a more developed terminology is required to explore the role and meaning of this site in the Iron Age. Qualitative terms already used include *genius loci,* sacred place, focal, enclosure, circle, axis, procession and threshold. Each is fundamental in the language and discourses of design philosophy (e.g. Heidegger and Hofstadter 1971), and architectural design theorists (e.g. Barrie 2012; Holl *et al*. 1994; Krier 1992; Norberg-Schulz 1980, 1985, 2000; Rykwert 1988). Where borrowed from those disciplines, a more complete typology of relevant concepts for narrative purposes is given in Table 8.2 to help address the more fundamental questions raised by all prehistoric architectural constructs and archetypes, Lismullin 1 included.

The data in Table 8.2 are typified here as ideational i.e. characterised by their intended meaning(s) and motivation(s) in the mind of the designer as distinct from attribute or relational type data which are measureable and observable. However, ideational data are subject to individual judgement and interpretation and this can result in analytical outcomes that are neither mutually exclusive nor unique. While such boundary problems and dangers of misinterpretation have been recognised (e.g. Layder 1992), these data are arguably interdependent and relationally tied, and are thus considered here as a linguistic network composed of nodes that are linked by their perceived relationships. Such an approach allows the methodologies of social network analysis (hereinafter SNA) to be used for qualitative analysis purposes and has the potential to examine such a schema for evidence of centrality (relative importance) in order to develop a more coherent and structured narrative. SNA tools are based on graph theory, are interdisciplinary, and used in the scientific study of networks of many kinds encountered in a wide range of disciplines (e.g. Newman *et al.* 2006; Newman 2010; Wasserman and Faust 1994). One of the most useful methods used in SNA is to visualise linked data as a graph i.e. a network consisting of nodes (actors) joined by lines that represent ties that are either measured or observed, or interpreted as in the case of ideational data.

Table 8.2: Typology of ideational data.

Axis	Entrance	Memory	Sightline
Axis mundi	Experience	Place	Threshold
Boundary	Focal	Phenomenology	Transition
Edge	*Genius loci*	Processional space	Transitional space
Enclosure	Locus	Sacred space	Visual field
			Zoning

Using the data in Table 8.2, Figure 8.4 is the graph of all nodes and their proposed links. Each node is shown relatively scaled using the Degree Centrality (C_D) index of centrality computed in UCINET 6 software (Borgatti and Everett 2002). The C_D index ranks the relative importance of each actor in this network based on the number of ties/edges that connect it to other nodes. A standardisation of the measure is determined by:

$$C'_D(n_i) = \frac{d(n_i)}{g-1}$$

where g = number of actors and d is a constant (Wasserman and Faust 1994, 179).

Notwithstanding the limitations and potentially subjective nature of the writer's approach as previously explained, the results show that based on the determined values of C_D, axis and processional space obtain the highest scores on such a scale ($C_D = 8$) and zoning the least ($C_D = 2$). These rankings are used to structure the following narrative.

Axis, processional space (Degree Centrality 8)

The majority of prehistoric constructs exhibit the concept of axis. It is the most basic planning device used to orientate and achieve symmetry in any built structure. In Ireland at least, megalithic monuments (tombs, circles and stone rows) show clear evidence of axiality and, in some cases, these probably symbolise culturally meaningful directions in terms of intentional alignment towards either built, landscape or celestial targets of symbolic importance. British Iron Age roundhouses similarly exhibit a strong sense of axiality as well as easterly orientation, some towards propitious celestial events at calendrically significant times (Cunliffe 2005, 577). Further comparisons can be made with European and British sites with reference to the spatial form of Iron Age ritual structures and the differential use of constructed space (Smith 2001; Webster 1995, 455–458). Significantly, Manley (2000) provides a highly relevant report on the likely method of design and use of Building 3 at the Fishbourne Roman Palace complex in England, which was constructed in the middle years of the 1st century AD. An Iron Age temple discovered at Heathrow further provides a tantalising glimpse of an enclosed settlement site in Britain that has exact chronological contemporaneity with Lismullin 1 (Grimes and Close-Brookes 1993). The roofed structure is a double-rectangle in plan with a formal portico entrance more typical of Early Roman temple architecture but on a much smaller scale than Lismullin 1. The timber post-holes are concentric and the co-aligned entrances face north-southeast (Fig. 8.5).

Grimes originally interpreted the rectangular structure as a temple when it was first discovered in 1944 but later interpretation by Close-Brooks advises caution on the use of this terminology, and of the possibility that it may have been a shrine (Grimes and Close-Brooks 1993, 331). In his study of the orientation of English churches, McCluskey (2007, 345) refers to the appropriateness of orientation in an easterly direction and has identified azimuth peaks centralised around east-northeast (similar to Lismullin 1). While this reference relates to a different tradition and set of dedications, a desire for orientation in that direction for religious/ritual reasons may be a common factor.

Axis, path (aisle) and centre are inextricably linked in a design sense. Taken together, axis and path convey a strong sense of directed physical movement toward or away from a focal target i.e. toward another element of the complex, or towards a target that may have cosmic significance in terms of how a building is used. Additionally, path is the 'fundamental existential symbol which concretises the dimension of time' (Norberg-Schulz 1980, 55). In

the context of Lismullin 1, the avenue may have functioned as a '*via sacra*' for the users, and until they reached the point where physical movement toward the sacred centre was impeded by the elongated pit containing burning charcoal. Such a concept has its design equivalent in modern Christian churches in terms of processional movement towards the terminus strategically located at the altar rails. This architectural element acts as a ceremonial barrier between public space and inner sacred space.

Boundary, enclosure, focal, locus, place, threshold (Degree Centrality 7)
The architectural completeness of temples conveys a measure of their sacredness and this usually denotes the concept of boundary acting to enclosure or exclude participants. Thus, the 'boundary or limit is a characteristic of sacred space' (Tuan and Strawn 2009, 21). Furthermore (*ibid*.), power and sacredness are intertwined there. Where a boundary is crossed or penetrated, as at the entrance to Lismullin 1 for example, the participant is moving between two worlds regulated by different operational codes and rites of behaviour. In an Iron Age context, Hingley (1990, 96) also refers to boundary as an element of enclosure, how it acts to socially exclude/include, and how it can perform as a symbol of status or power. Cunliffe (2005, 577) states that the interior spaces of Iron Age houses were probably carefully structured 'so as to contain behaviour', but that any evidence in support of that thesis was lacking. Additionally, he identifies structured space as a characteristic of all enclosed spaces and that these were governed by strict taboos and codes of practice conducted in specific designated spaces (and see Fitzpatrick 1997, 78). The English painter John White provides important sixteenth-century evidence of these concepts operating amongst the Secotan Indians of North Carolina (Fig. 8.6).

This depiction shows the Green Corn Festival which celebrated the first harvest of Indian corn (maize) at the end of summer. The elements of centre, enclosure, boundary and structured space are striking in this scene. The seven posts decorated with human faces are thought to symbolise deities. The sacred innermost space at the centre depicts three women and implies segregation between them and the encircling participants bearing gourds and branches.

The activities shown in Figure 8.6 additionally epitomise focality i.e. centrality of design that draws the eye and thus focuses the attention of participants in the ritual. As argued by Fleming (1972, 59) the minimum design requirement for ritual space must include focal point(s) for the activities of the principals. While locus may denote a focal point, it more explicitly describes a very specific place chosen for its *genius loci* properties in keeping with the intended role of the monument. The concept of place conveys the human desire to select a temple site that will embody the necessary/ideal topographical, elemental and other characters befitting its ritual function. These ideas are previously exemplified in Figure 8.1 by the landscape setting and the optimal scale and centralised positioning of the monument within the enclosing ridge.

The element of threshold is dramatically articulated at Lismullin 1 by the location of the elongated depositional pit – spatially and proportionally located between the western end of the avenue and the inner enclosure. The concept of threshold conveys the strongest sense of barrier and significance in design terms. Votive offerings are known to have been placed in the pit and such acts of ritual were possibly synchronised to take place in the period of the year following the annual harvest. Elsewhere, support for such an argument is found in an interpretative description of every day life in Iron Age Wessex (Fitzpatrick 1997, 80).

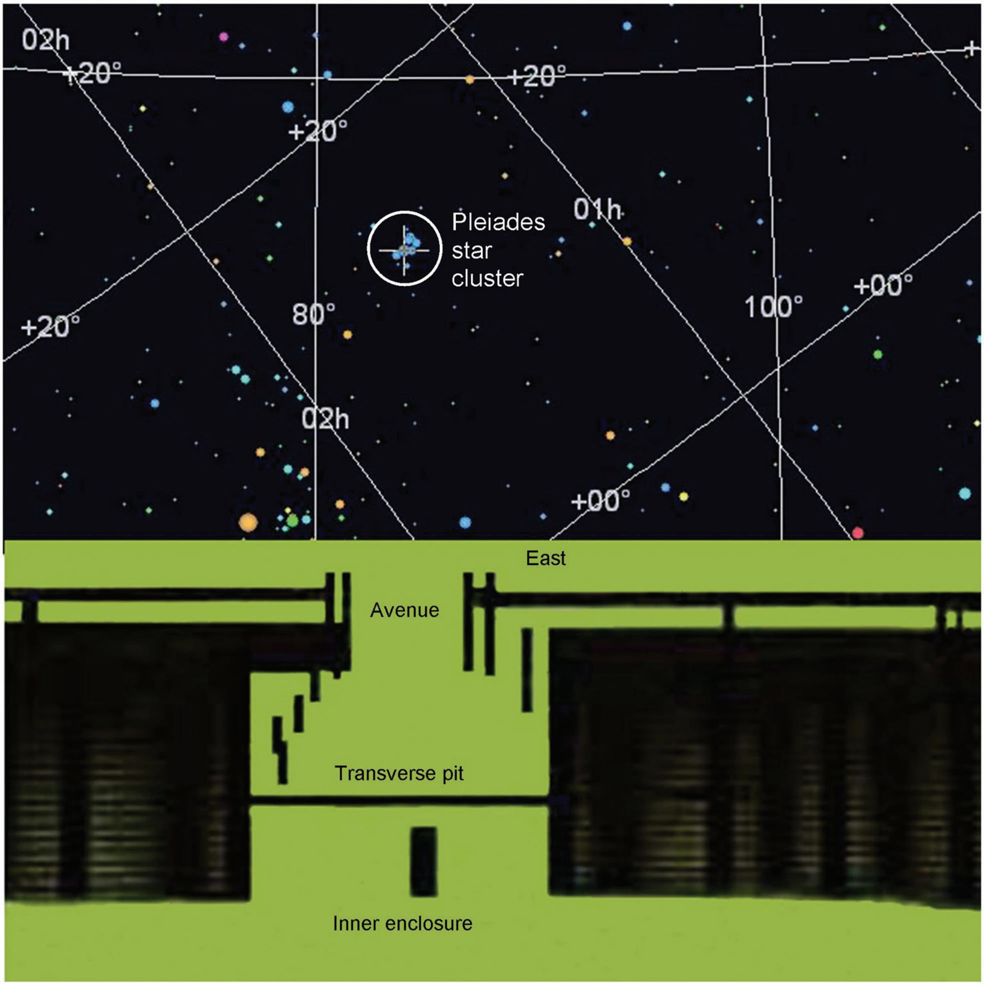

Fig. 8.3: Autumnal sky viewed from the inner enclosure in c. *400 BC.*

Axis mundi, memory, sightline, transitional space (Degree Centrality 6)
Sacred architecture has, and always had, a 'mediating role' and 'the sacred place was (and still is) an intermediate zone created in the belief that it had the ability to engage, elucidate and transform' (Barrie 2012). In his discourse on religion and architecture, Barrie further argues that the root meaning of religion is to 'bind together', and that connection to a deeper understanding is only possible through belief and participation in religion so as to connect humans with their gods. Thus, the creation of ritual space, and place, is a human act intended to 'embody symbolic content' (*ibid.*) and to demarcate it for transformation and special use. The centre of such a space, once selected, assumes a new significance in terms of how it can figuratively link a built ceremonial structure to the cosmos in a vertical

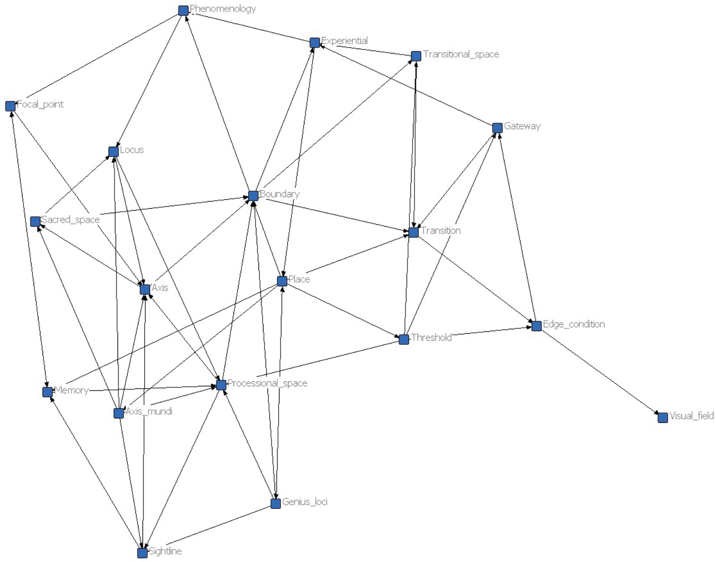

Fig. 8.4: Degree centrality scores.

Fig. 8.5: Reconstruction of an Iron Age temple and farm at Heathrow in c. *500–300 BC by Alan Sorrell © Museum of London and Bridgeman Art Library. (Inset: archaeological plan of the temple after Grimes and Close-Brooks 1993, fig. 9).*

sense – either above (zenith) or below (nadir). This defines *axis mundi* (Fig. 8.9). Jaffé (1999, 272) provides support for this argument in relation to designed classical or primitive building foundations and how those could be 'transformed into an ordered cosmos, a sacred place bound by its centre to the other world'.

The element of sightline is considered crucial in terms of the performance aspects of a building or a temple (Rykwert 1988). Sightline incorporates directionality and links the eye of the viewer/audience with a ritual referent – architectural, topographical or celestial. At Lismullin 1, the eye of the participant located within the inner enclosure would have been directed along the axis of the avenue towards the horizon and the sector of sky laterally bounded/framed by the avenue sides. As a design factor, Ritchie (2004, 11) links constructs and the horizon by stating 'skylines can themselves be monuments and monumental'.

In any ritual setting, formal movement is a core behavioural act. Thus, entering, exiting and processing within or around the complex through its designated spaces can help to realise the designer's ideas and ritual expectations of transitional space and as a zone of engagement to be used at auspicious times.

Edge (Degree Centrality 5)

Although equivalent in one sense, edge, unlike boundary, describes the experience and perception of being positioned at the periphery. At such a location, inclusion and exclusion become metaphors for social status and entitlement for participation in ritually controlled acts.

Entrance, genius loci, sacred space, visual field (Degree Centrality 4)

Krier (1992, 46) considers an entrance to be a symbol and as 'playing a decisive role in preparing the visitor for the spatial event to come' and for it to be 'in geometrical harmony' with the space within. At Lismullin 1, the emphasised nature of the larger-diameter post-holes suggests that the entrance (like a doorway) was intended to be proportionately in harmony with the large area enclosed by the 80 m diameter enclosure beyond. Such aspirations are described by Krier (1992, 27) as reflecting a desire to achieving 'a well balanced and meaningful composition that reflect an understanding of the relationship between form, proportion, effect and function'. An entrance is also another example of a threshold that can be used to divide, demarcate and segregate different designations of space and users (Fig. 8.8).

Genius loci refers to the idea of the character of a place or a landscape. It is experiential rather than quantifiable. Thus, at Lismullin 1, the elements contributing to its *genius loci* would have been the discreteness of its setting, the feeling of locally pronounced elevation above the river, proximity to the river, the act of ascension needed to access the complex, and visibility of the sky.

Sacredness implies reverence – either for a place, a structure or an object. Sacred space may contain a shrine or a temple. The shrine and the temple are manifestations of sacredness, each differing in their scale and context. In some cases, a shrine may be part of a larger temple. Both, however, embody a given set of religious beliefs and traditions.

When viewing Lismullin 1, its architecture has a strong bias in the horizontal plane; the relatively low height of the reconstructed timber posts and mostly level ground confirms this (Fig. 8.9; and see O' Connell 2013, 65). It might be argued, then, that the visual field and impact generated by the structure is in harmony with the dominant biological bias of the human eye in that plane.

Experiential, phenomenology, transition (Degree Centrality 3)
Impact and feeling result from being situated in a particular space or ceremony and these qualities capture the essence of experience and phenomenology (e.g. Husserl 1970, 219–220; Tilley 1994, 11–17). The functioning of a temple involves movement and transition from space to space in a coordinated manner, and as dictated by ceremonial codes of behaviour.

Zoning (Degree Centrality 2)
Zoning is a conceptual planning tool that achieves its intended design aims through the regulated use of entrances, boundaries and pathways. Where successfully used, physical movement and mental transition can become unified in terms of the overall design rationale.

Structured Space – Structuring Space

Reconstructing prehistoric traditions is normally reliant on assessing the context of extant material culture recovered by archaeological excavation. Such approaches are sometimes constrained by how such evidence can be interpreted in a social context. Where applicable, the mechanism of oral tradition may only hint at this in some cases. The existence of any early literary sources that record traditions in a time chronologically close to a lost history is thus of immeasurable importance. Mac Cana (1995, 779), however, advises caution on the 'degree to which the extant corpus of medieval Irish literature may be accepted as a reliable index on native mythology and religion'. He emphasises the inherent dangers posed by reliance on early chroniclers whose writings are based on earlier descriptions of the beliefs and practices of continental and British Celts recorded by the various Greek classical authors (e.g. Diodorus, Hecateus, Hesiod). Mac Neill (1921–1924) has arguably overcome this problem through his translations of the chief collection of the oldest written Irish laws of jurisprudence. These are contained in a compilation called *Senchus Már* which can be dated to the seventh century AD. The collection was written at a time when Ireland was divided into *c.* 90 Tuathas (provinces) each ruled by a king. Chronologically, this knowledge was recorded just a few centuries after the ending of the Late Iron Age. It contains an important and relevant description of the 'law of status' as used by a king to segregate residential space and position guests in his house (*ibid*. 308). There is a clear reference to entrance orientation, and orientated seating arrangements of the guests according to their status, dignity and precedence (Fig. 8.7).

In the example, the entrance is positioned in the west and the seating of guests adheres to a strict protocol. Principals were seated in two rows aligned east-west and these faced each other (due north and south). The king, his wife and a judge sat in the east and thus faced west towards the entrance. While the evidence for this is literary only, such a schema (conceptually at least) is a likely metaphor for power and status attained through structured space.

A typology of structured ritual space

Architecture typologically classifies space through the recognition of ground plan shapes and groups these in terms of their function in a building or space. At Lismullin 1, the variation

Fig. 8.6: Festive harvest dance of the Secotan Indians c. *AD 1585–93 © The British Museum.*

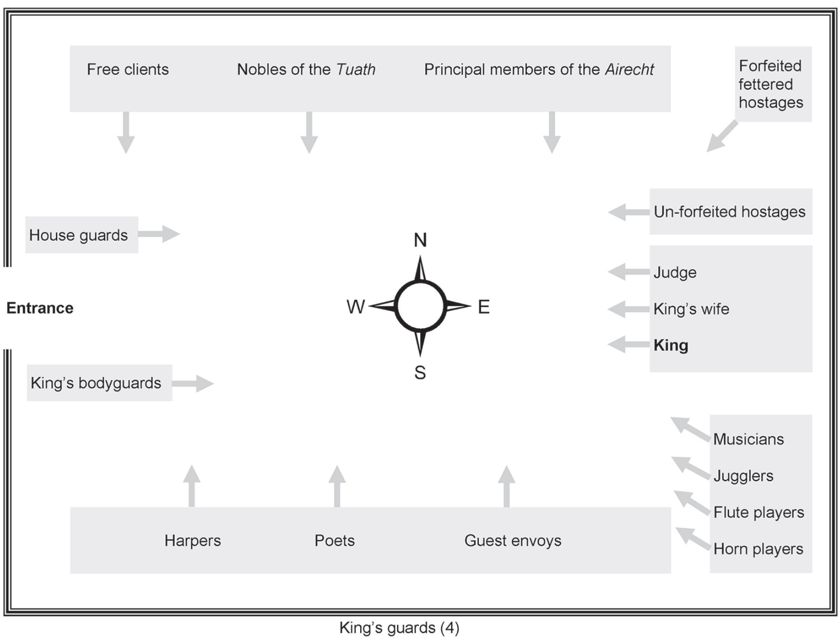

Fig. 8.7: The law of social status in 7th century Ireland (after Mac Neill 1921–24).

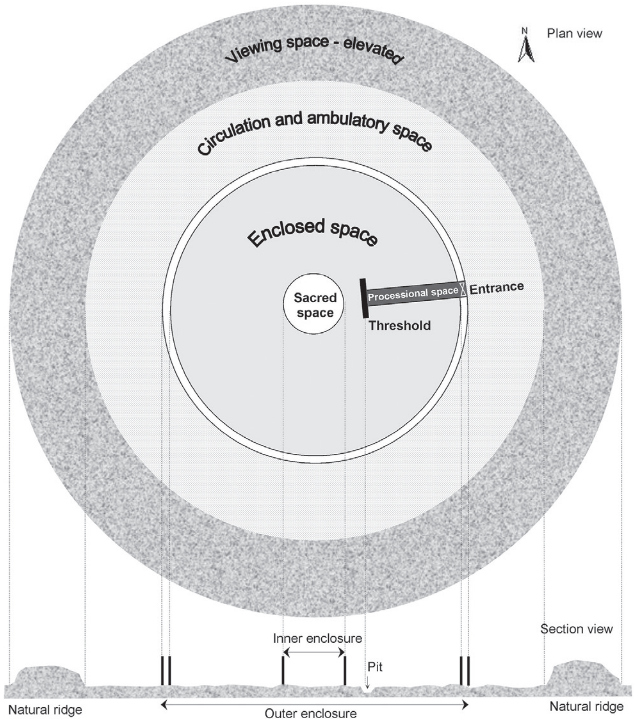

Fig. 8.8: Typology of structured space for Lismullin 1.

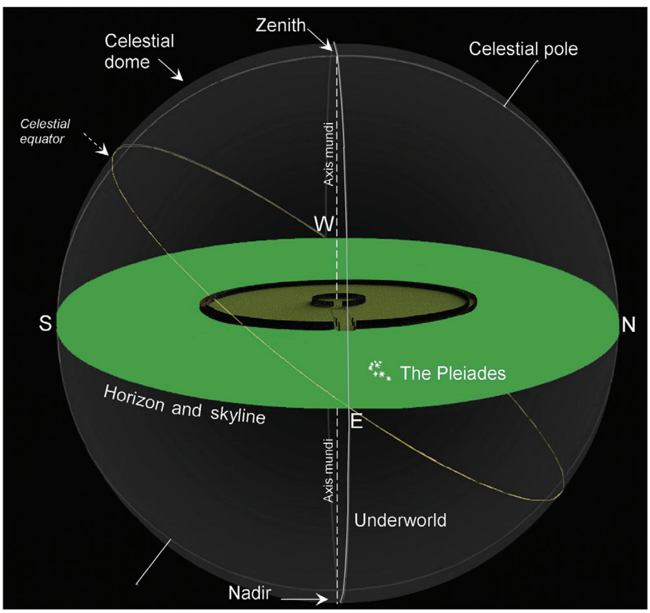

Fig. 8.9: A cosmology for Lismullin 1.

in geometric form is simple and limited. Nonetheless, a typologically structured approach to viewing such a space suggests how setting, form and function can arguably achieve balance and harmony in the overall design (Fig. 8.8).

What may be significant is the manner in which the pit is geometrically offset from the central enclosure. Yet, it is strongly tied and balanced to the axiality of the complex, the avenue and the entrance. When viewed in this manner, the design and spatial relationships of the elements are more clearly understood in terms of their potential ritual role and function.

Conclusion

Cosmic order and harmony in any society can be achieved through the mechanism of architecturally motivated spatial organisation. Such concepts, and the elegant use of built form, are well articulated in classical Greek and Roman temple architecture. Those harbour many layers of embedded meaning beyond their known dedication to important deities. However, across space, time and cultures, the spontaneous appearance of similar archetypes, and ideas, does not necessarily depend on outside contact, or an invasion hypothesis, to explain their presence. Such manifestations can reproduce themselves anywhere in any time, and need not have had a known origin (Jung 1990, 58). Indeed, at the time Lismullin 1 was in use, Ireland largely existed beyond any influence from Roman Britain (Raftery 1995, 638–39). Raftery also claims that after about 600 BC, Ireland lapsed into a phase of ‘introspective isolation’, Hallstatt D influences to be almost undetectable, and the earliest phases of the continental La Tène culture to be entirely absent. It would not be until *c.* 300 BC, when Lismullin 1 went out of use that any significant evidence of external links with Britain, or beyond, can be discerned in the record. That argument is consistent with the idea that a common religion or belief system did not exist in any wider regional sense (Joy 2011, 405) and that, instead, Iron Age religion was practised on a local scale.

Lismullin 1 exhibits the hallmarks of a temple site – large scale, formal entrance, processional space, threshold, depositional space, viewing space, openness and planned orientation. Interestingly, any evidence for prehistoric sacred space in Iron Age Ireland is scant. Thus Raftery (1994, 179) alludes to the difficulty of reconstructing religious beliefs from a minimal archaeological record and the need, instead, for tentative suggestions and questions. For Iron Age Britain, Smith (2001, 9) describes a similar dearth of evidence there, and that ’any great homogeneity of religious function’ cannot be assumed.

In attempting to reconstruct a cosmology for Lismullin 1, wider concerns with how religion was practiced in the prehistoric are relevant though. As Ingold (2007, 154) states ‘Certainly religion and its associated philosophies and rituals can be more pragmatic, and utilitarian, than our interpretations often allow, and involve the fusion of practical, economic, and esoteric concerns.’ Based on the evidence and argument presented here, the recurring religious/ritual/ceremonial acts conducted at Lismullin 1 might be conceived as being part of the hypothetical world view model shown in Figure 8.9.

Here, the *axis mundi* anchors the centre of the temple to the apparent dome of the sky and creates a bipartite division of the world – above and below the horizon. Cardinal directions are shown to signify a probable awareness of these directions, but not necessarily with any degree of precision. The temple, the surrounding landscape and skyline, and the deliberate

easterly alignment of the avenue towards, perhaps, a meaningful celestial referent, complete the model.

While these ideas are site specific, they do have a universal relevance in time and space. Lewis-Williams (2005, 65) describes a regional tiered cosmology for the precolumbian inhabitants of Mesoamerica with elements that overlap the model developed here. As Jaffé (1990, 272) puts it, transforming space into an ordered cosmos accords with 'the vital feelings and needs of religious man'. When Faust (2001, 149) observed that the orientation of Iron Age houses in Israel predominantly faced the east and avoided the west, he could offer no functional explanation for the phenomenon, and advised that 'the solution should be sought in another realm'. Perhaps the discourse here has provided some enlightenment on this question by offering added perspectives that may enrich and deepen our understanding of an enigmatic monument and a lost history.

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9

The Circumpolar Skyscape of a Pembrokeshire Dolmen

Olwyn Pritchard

The 'King's Quoit' dolmen, at Manorbier, in South Pembrokeshire, is an enigmatic monument. It stands beside the coast path, near the end of a headland, facing inland across a small sheltered bay. Despite being one of the most visited sites in Wales, it remains one of the least well understood (Fig. 9.1).

A dolmen is a megalithic monument consisting of one large stone resting on one or more smaller supporting stones. It is an originally Welsh term which translates as 'table-stone' in English, and is preferred by the author to terms such as 'chambered tomb', since in West Wales these monuments show only limited evidence of funerary use. As will be seen and explained below, there are arguably several different classes of dolmen in the area.

This paper describes the author's attempt to shed additional light on the chronology of the 'King's Quoit' dolmen and its potential cultural meaning and purpose. A landscape approach is adopted which includes other monuments that are inter-visible with the site and incorporates archaeology, astronomy and phenomenology.

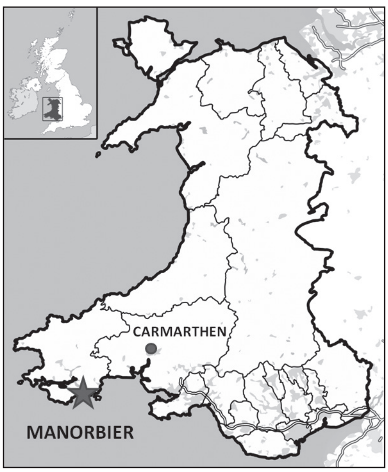

Fig. 9.1: Location map of The King's Quoit, Manorbier, on the south coast of Pembrokeshire, Wales.

The King's Quoit

The dolmen is constructed from slabs of the local bedrock, the Devonian Old Red Sandstone (Fig. 9.2).

The rectangular capstone, which measures 5.1 m × 2.6 m, is oriented approximately north/south, and rests against the base of one of a naturally occurring line of upright slabs. The outer end is propped on two smaller pieces of the same material. A third small slab stands alongside the capstone, at the inland end. Its position suggests that this was originally a third support, from which the capstone has since slipped. Erosion on the western or, seaward, side, and where the land now drops away quite steeply, may have caused the loss of other supporting orthostats. This would have allowed the capstone to move slightly downhill.

Fig. 9.2: The King's Quoit, looking northwest.

The headland, in common with the rest of the coast in the Manorbier area, is composed of strikingly coloured and fissured rock. Bands of deep pink, red and purple are interspersed with grey and green layers, and apparently bottomless clefts and chasms are formed through the erosion of softer strata. Blowholes are also a feature.

Local antiquarians, writing in the 19th century, commented on the striking landforms around the dolmen. For example:

> 'The singular beauty and romantic wildness of the little bay at Manorbeer (sic) is another distinguishing 'accidental' of this cromlech; while not far above it, in the hill, opens one of those yawning chasms going right down through the vertical strata to the sea beneath, which are some of the most remarkable features of the district' (Longueville-Jones 1865, 282).

Others pondered on the possible reasons why the dolmen (presumed to have been a tomb, or a cenotaph) had been constructed in such an inaccessible location (Barnwell 1872, 129).

With around 60 surviving dolmens in West Wales, recent authors have noted similarities in their surrounding landforms (Tilley 1994, Cummings and Whittle 2004). Tilley (1994) found that rock outcrops either in the vicinity or breaking the horizon are a common feature at many of the area's dolmens, and that over half (as at Manorbier) are located near the sea, even if not directly overlooking it. Tilley (1994, 2005) and Cummings (2002, 2004) hypothesised, through drawing on ethnographic data, that rock outcrops and springs could have been regarded by prehistoric peoples as having special significance, and that the location of monuments reflected this. Fleming (1999, 121) offered an alternative view, which proposed a higher survival rate for monuments located in rocky places, because the surrounding land was less easily cleared for agriculture or settlement.

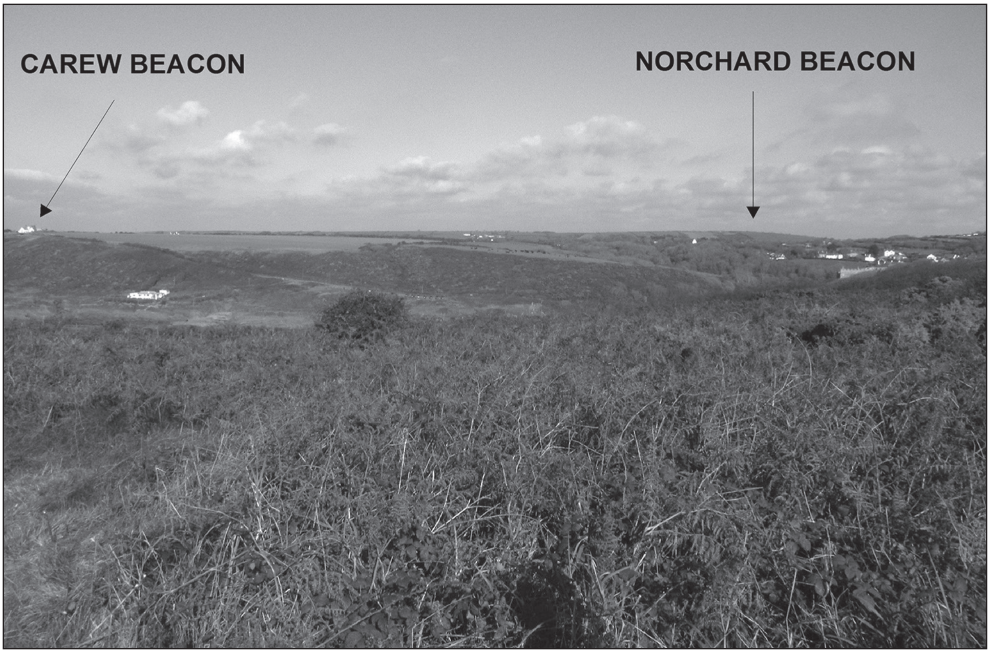

Fig. 9.3: The Pembrokeshire Ridgeway – as seen from a point just below the top of the headland, directly above the King's Quoit.

Situated as it is, set into a steep slope, distant views from the dolmen are limited. Only the north to north western arc of the horizon is visible, from 60 degrees to 240 degrees. Cummings and Whittle (2004), Tilley (1994) and Barker (1992) all note that restricted visibility of 180° degrees or less, due to a local high horizon, is a common feature among dolmens in west Wales. Cummings and Whittle compare these megalithic constructions with other prehistoric monuments such as henges, which usually have a more open view, and suggest that selecting a location, as at the King's Quoit, which created a strongly directed outlook was deliberate and possibly meaningful (2004, 37).

An observer standing at the Quoit will find that the limited field of view creates a vista encompassing the bay, bounded on the far side by slightly higher ground, which partly obscures a ridge, approximately 3 km to the north of the Quoit, and parallel to the coast. This band of hard-wearing rock produces the Pembrokeshire 'Ridgeway' and creates a long level horizon, on which are set two groups of round mounds, 5 km apart, alongside a road which now links the settlements of Tenby and Pembroke. The western group includes a named mound, Carew Beacon, and the eastern, Norchard Beacon (Fig. 9.3).

The phenomenology of these mounds, some of which can be seen from the Quoit, is very different from that of the more sheltered dolmen. Built of compacted soil, on the highest ground locally available, the Ridgeway mounds command an extensive view in all directions, encompassing sea, islands, and distant mountains, as do many other circular monuments in the British Isles (Bradley 1998). The soft outlines derived from the use of soil rather than rock as a building material, extensive views and hilltop landscape setting

of the mounds contrast strongly with the angular, stone built Quoit, its restricted angle of view, and sheltered, half-hidden, position tucked into a steep rocky slope above the sea.

Although the sea is a constant presence now, the exact position of the high-water mark in prehistory is uncertain. It has been suggested that current sea levels were reached at around 4600 BC (Taylor 1980, 117–9), but an alternative view (Bell and Walker 1992, 126), suggests that high-water during the Neolithic was around the present low-water mark. The remains of tree stumps and peat beds can sometimes be seen in the bay after winter storms have stripped off the modern beach deposits.

So, can a study of the landscape setting of the Quoit shed any light on its original cultural meaning or purpose? Tilley (1994) argues that broad similarities in phenomenology can be observed among many local dolmens, including the King's Quoit, citing proximity to rocky outcrops, and/or the sea, views of a particular mountain, the presence of nearby footpaths, and inter-visibility with other monuments, and believes that this has significance. Cummings and Whittle (2004) additionally added springs, bays, harbours, and caves to the list of features commonly associated with dolmens. They suggest (*ibid*., 87) that locations on the sides of hills, valleys, or as at Manorbier, on a headland, placed these structures in a liminal position between the lower, more fertile land used for gathering, fishing, herding and hunting, and the higher, rockier, more marginal areas less visited in everyday life.

All hypothesise that monuments such as the King's Quoit, placed against rock outcrops, resemble artificial caves, and to enter a cave is akin to entering another world – an 'underworld' (Tilley 1994, 96; Cummings and Whittle 2004, 87; Bradley 1998; Hayden and Villeneuve 2011). Placed in transitional areas, such as between fertile earth and rock, land and sea, or at the heads of rivers, where water issued from the ground, such monuments could be seen as being sited at places 'in between' representing the combination or resolution of opposing forces, such as life and death (Cummings and Whittle 2004, 87).

Even today, the headland at Manorbier has a liminal quality, sited as it is away from the farmland, shops and houses, between land and sea; a place of rock and water. The dolmen can only be reached by traversing a perilous narrow path; a spring rises close by, and rocks are still a feature as is the apparently bottomless vertical shaft which opens in the hillside above the monument, suggestive of an entrance to some dark interior realm. The mounds, located on the high ground of the Ridgeway, can, likewise, be regarded as being in a liminal zone, i.e. between earth and sky, on the way from one place to another.

Fleming (1999) chose to emphasise differences, rather than similarities, both in the construction and orientation among the Welsh dolmens, and suggested that this indicated (*ibid*., 120) an individualistic concern with site-specific design and ritual on the part of the builders rather than a search for phenomenological consistency. Fleming also makes the point that the terrestrial is emphasised by Tilley, Cummings and Whittle, while astronomical aspects and celestial phenomena are overlooked.

He states:

> 'The tomb – might have been built by people who saw rocks, springs, bogs or rivers as liminal places.. on the other hand ..its builders might have been sky oriented ..it may be that the location of the site itself did not matter ..it was the link with the sun or moon which was important' (Fleming 1999, 124).

This valid criticism is addressed later in this paper. However, and before any archaeo-astronomical investigation of the King's Quoit is undertaken here, due to changes in the

positions of the heavenly bodies over time, it is first necessary, through archaeology, to consider the construction date of the Quoit, and to incorporate the archaeology of the Ridgeway mounds because of their proximity and visibility in the same landscape.

Archaeological Assessment

Past writers on the various Welsh dolmens (Barker 1992; Tilley 1994; Cummings and Whittle 2004; Children and Nash 1996; Nash 2008; Lynch 1972, 1975, 1976; Figgis 2001) have ascribed a blanket 'Neolithic' origin to the entire group, based on the evidence of a few excavations (e.g. Lynch 1975, 1976; Rees 1992; Grimes 1959; Wainwright 1968). The regional Historic Environment Record (HER) similarly lists the King's Quoit as Neolithic, although there has been no recorded excavation of this site to date.

Morphologically, there are several loosely defined regional sub-groups of dolmens inWest Wales (Nash 2008; Lynch 1972). Although the King's Quoit does not exactly resemble any of these, Daniel (1958, 36–7) tentatively classifies it as belonging to his 'earthfast' category, where the capstone has one end firmly placed on the ground, being propped by one or more supports at the other, creating a triangular cross section.

Nash (2010) Barker (1992) and Cummings (2002, 2004) discuss the earthfast dolmens of North Pembrokeshire, and, informed partly by the excavation evidence of Fenton (1848, 284; 1810, 22–3), and partly by structure and phenomenology, have hypothesised that they were constructed in the late Neolithic or Early Bronze Age. Cummings (2002, 99–101, 2004, 39–40) argues that their location, camouflaged amid rocky landscapes, is phenomenologically different too, and this factor sets them apart from the more visible 'portal' dolmens which are often sited on less steep and rocky land. The 'portal' dolmens of West Wales generally consist of a more massive capstone than the slabs which form the Quoit, or the earthfast monuments. Portal dolmens also have the capstone set upon three or more evenly spaced orthostat legs, sometimes, but not always, with a blocking stone set between the orthostats which seem to form an entrance.

Some portal dolmens have been excavated e.g. Lynch (1975), Rees (1992) and, Grimes (1959), and have yielded pottery of the Early Neolithic type. In some cases, but not all, small quantities of cremated human bone, also dating to the mid fourth millennium BC, have been found.

At the King's Quoit, establishing a date of construction is difficult. As previously stated, no excavation has been undertaken, and the monument does not exactly resemble either the earthfast dolmens, or the portal dolmens, in form. The presence of a third orthostat towards the rear (from which the capstone may have slipped), and possible lost supports on the western side, suggests that the capstone of the Quoit may originally have been fairly level and evenly supported creating a low, box-like form, dissimilar to both the earthfast and portal dolmens.

The monument is also geographically isolated from the main groups of both earthfast and portal dolmens in the region, which are located to the north and west of the peninsula. Its closest neighbour, both spatially and morphologically, is the Devil's Quoit near Freshwater West beach approximately 33 km to the west, also situated on a headland. Both the Devil's Quoit and King's Quoit are similar in construction style to several large, slab built cists

which have been found within round mounds along the South Wales coast, including one at Cortson Beacon, further west along the Ridgeway, midway between the two Quoits. Both the Quoits, and all the various cists, are located within 2 km of the sea.

Excavations at three of these cists – Corston (Fox and Grimes 1928), Allt Cunedda (Fenton 1851), and Candleston in Glamorgan (Ward 1918; Savory 1980), have produced pottery of the Food Vessel tradition, and/or Early Bronze Age daggers, in addition to single burials which are mostly extended inhumations. A combination of AMS (Accelerator Mass Spectrometry) dates, pottery and metalwork style, gives a date range for all of around 2100 BC–1900 BC (Brindley 2007; Savory 1980). It therefore seems a reasonable hypothesis to suggest that the King's and Devil's Quoits might also belong to this group, on the grounds of their similar morphology, location, i.e. on raised ground within sight of the sea and, geographical proximity. Moreover, in all cases, (including the cists), orientation of the capstones is north/south. This could suggest an Early Bronze Age date of a century or two at most on either side of 2000 BC, for the King's Quoit, rather than the early Neolithic date usually ascribed to dolmens in west Wales.

Regarding the archaeology of the mounds on that section of the Ridgeway inland of the King's Quoit, there is a little more evidence. Several of these monuments were the subject of antiquarian excavation in the 1850's (Smith 1877, 39–40; Deardon 1851, 291–4). Two Food Vessels were recovered, one of which was an intensively decorated bowl. Brindley (2007) carried out radiocarbon dating on bone from burials incorporating similar vessels found elsewhere in South Wales and dated this pottery style to 2100 BC– 1900 BC. A barbed and tanged flint arrowhead was recovered from Carew Beacon, in addition to an ivory ring neatly decorated with alternating lines and dots. This was similar in style to the decoration found on the only known Welsh lunula (Deardon 1851, NMW), These finds are all consistent with an Early Bronze Age date for the mounds.

One of the eastern group of mounds concealed a large slab built cist, recorded as being of identical rock type, and similar size, to the Quoit. Inside this lay a single extended inhumation, as found in the Early Bronze Age graves at Corston Beacon (Fox and Grimes 1928) and Candleston (Ward 1918).

So, although archaeological data for the Quoit itself is somewhat minimal, taking all the evidence together could suggest an origin for both the Quoit and the Ridgeway mounds that is contemporary with the Food Vessel tradition of the Early Bronze Age. Additionally, both the Ridgeway and the headland at Manorbier have been find-spots for worked flints dating from the Mesolithic to the Bronze Age (Tilley 1994; Leach 1913; Dyfed HER). A burnt mound is recorded (Dyfed HER) at the back of the bay at Manorbier, and a deposit of bronze items has recently been recovered from near the western mounds, although this material is of later Bronze Age style (Dyfed HER). Collectively, these data are indicative of an enduring interest and presence the area by humans in the prehistoric past.

Archaeoastronomy

Fleming's comment (1999, 124) that current phenomenological approaches excluded the sky, seems a valid one, and resonates with the author's long standing interest in the astronomical aspects of prehistoric sites, informed by writers such as Ruggles, Thom, Heath, Sims, and

the various contributors to this volume. Also, the apparently deliberate creation of directed visibility at this and other dolmens in West Wales studied by Cummings and Tilley suggest that there may have been an intention to emphasise a particular view. In this case there are no striking landforms or iconic hills in the vista, but there is a level horizon to the north and a large expanse of visible sky.

The presence of high ground immediately to the south of the King's Quoit had initially made the site seem barren in terms of astronomical alignment potential. There was no possibility of viewing the midwinter sun; indeed, fieldwork had previously confirmed that the sun was not visible from the Quoit at all for 35 days either side of winter solstice. Likewise, the more southerly limits of the moon's rise and set positions would be hidden behind the headland. The summer solstice rising and setting sun is visible from the site, as would the most northerly moon positions be, but with no obvious foresights. The Quoit does however offer an ideal location for viewing the distant northern horizon and stars, turning through the night above the Ridgeway with its clusters of mounds.

Methodology

Fieldwork at Manorbier with a compass and clinometer showed the nearest horizon at the back of the bay to have a horizon altitude of 8° degrees. A small section of the Ridgeway, some 3km to the north, is visible from the Quoit, in the 'V' of a valley running inland. Norchard Beacon, the most easterly mound, can be seen from the Quoit on the horizon in this gap.

Climbing 20 m to a ledge below the top of the slope behind the Quoit allows for an un-obscured view of the entire Ridgeway. Compass bearings from the headland to the two groups of mounds gave readings of around 330–335 degrees for Carew Beacon and the western group, and 30 degrees for Norchard Beacon and the eastern mounds.

Use of the 1:25,000 Ordnance Survey sheet OL36 to measure angles more precisely showed that, after correction for the effects of magnetic variation, grid north and meridian convergence, the two groups of mounds lay almost equally on either side of true north at azimuths of 333° and 23–27° respectively. Calculating the horizon altitude of the Ridgeway mathematically with respect to an observer at the Quoit itself, produced a figure of 3 degrees. Most of the ridge cannot be seen from the Quoit, however, only the small area around Norchard Beacon.

The author used a computer programme – SkyMap (Marriott 2005), and initially masked the local northern horizon at +3°, which is the altitude of the Ridgeway as viewed from the Quoit. The positions of the mounds were marked on this scene and stellar movements, particularly the lower culminations, were checked at various dates, beginning at 2400 BC, that being the earliest date for Food Vessel activity (Brindley 2007).

Results

The author's hypothesis was that the Quoit was so placed that some observation of a stellar event or events taking place in the northern part of the sky could have been made from that location, possibly also involving the mounds on the Ridgeway.

The computer showed that at around midnight at the end of our modern month of

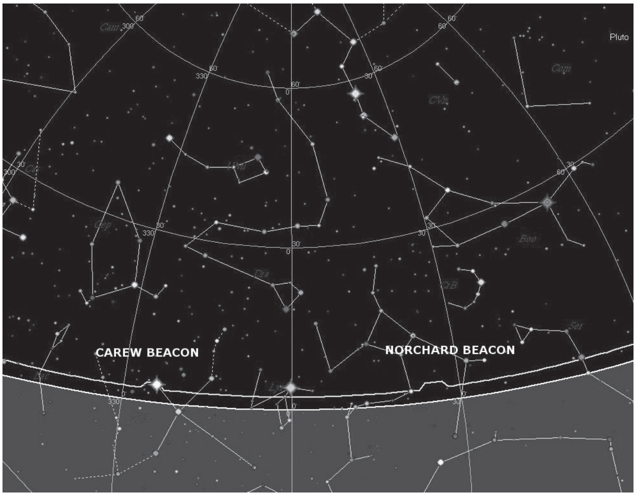

Fig. 9.4: Image from SkyMap (Marriott 2011) showing Deneb setting at the Carew Beacon and the lower culmination of Vega c. *2000 BC.*

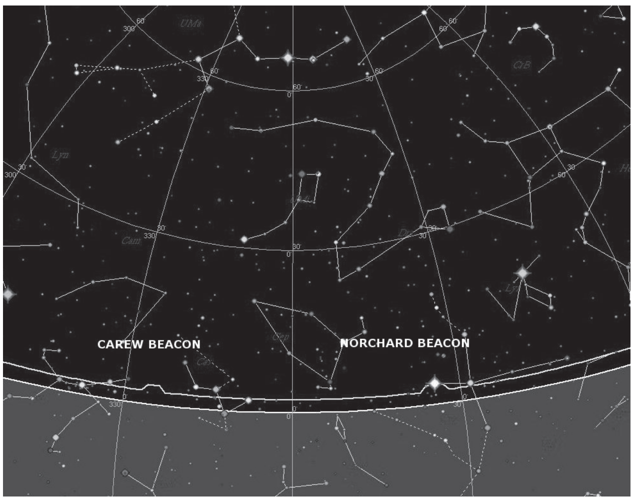

Fig. 9.5: Image from SkyMap (Marriott 2011) showing Deneb rising behind Norchard Beacon with Vega above and to the right (east) of Deneb, c. *2000 BC.*

December in 2400 BC the bright star Deneb, magnitude 1.25, would have set below the northern horizon, at altitude 3° passing through Carew Beacon to the west of north as it did so. About four hours later it would have risen from behind Norchard Beacon group to the east of north. Furthermore, as Deneb set, the lower culmination of the bright star Vega, magnitude 0.02–0.07, was almost tangential with the northern horizon before rising again (Fig. 9.4 and Fig. 9.5).

By 1900 BC this observation was still valid for Deneb although the declination of Vega had changed, causing it to culminate closer to the northern horizon than it had 300 years earlier. At the time the mounds were constructed, Deneb, as viewed from the Quoit, set and rose at positions coinciding with the Carew Beacon and Norchard Beacon mounds. This result was very satisfactory except for the fact that the setting point of Deneb cannot be seen from the dolmen itself. Although Norchard Beacon, with Deneb rising behind it, can just be glimpsed from the Quoit in a V-shaped gap, in order to see both groups, it is necessary to climb higher as previously described. This, however, lowers the horizon altitude as viewed from the headland, and Deneb would not coincide with the mounds, but culminate close to the horizon between them.

It appeared that although Deneb set behind the near horizon in line with the position of the Carew Beacon group to west of north, the conjunction of star and mound could never actually be witnessed. Additionally, Vega set briefly to the west of due north, before rising again a few degrees to the east, and there seemed to be no marker for this.

Further investigation using SkyMap revealed that between 4000 BC and 3500 BC, Vega had transited higher across the northern sky, coming down to a nadir of 8° – which would have meant that it appeared to touch the land behind the bay at the lower culmination, when viewed from the Quoit. Deneb meanwhile was still setting and rising in much the same place.

By 3200 BC Vega, as seen from the Quoit, was setting briefly, and as time went on, the culmination became lower. Deneb gained altitude over time and after about 1600 BC culminated close to due north, missing the mounds altogether.

Although the setting and rising of Deneb and Vega during the Early Bronze Age could be observed to good effect during the longest, midwinter nights, in early May Deneb would be observed rising at dusk, and in early to mid November it would rise in the dawn sky roughly an hour before the sun.

Schaefer (1986) and Ruggles, (1999, 52) both question whether stellar alignments would ever have been significant, or deliberately created by prehistoric peoples, because atmospheric effects near the horizon can cause changes in the apparent position of a rising or setting star. Schaefer (1986, 40) calculates that the observed azimuth of the rising or setting of Deneb and Vega could deviate by as much as 3° from the theoretical position due to varying atmospheric conditions. However, Prendergast (pers. comm.) has pointed out that although refraction may alter the observed apparent vertical position, and extinction can alter the altitude at which a star can be first/last seen, neither effect will negate the symmetrical effect vis-à-vis the north which could have been observed from the dolmen. Additionally, in this particular case, the near horizon especially is fairly close, about 200 m distant, and Deneb and Vega are two of the brightest stars, Vega being the fifth brightest star in the sky (Ridpath and Tirion 1984, 174). Arguably, because there is only a small distance involved, on a clear night these two bright stars as viewed from the Quoit or the headland above it, almost certainly would be visible sinking to meet the land and rise above it again, in the close vicinity of the mounds. Also, both groups of mounds span a distance of at least 100 m along the top of the Ridgeway. This is especially true of the eastern group, which subtends an azimuth of around 4°, as viewed from the Quoit, creating a relatively wide foresight. Therefore even if atmospheric effects did cause an apparent slight shift in the rising or setting position of the stars, they would be unlikely to miss the location of the mounds completely. Fires lit on the summits would increase their visibility from the headland.

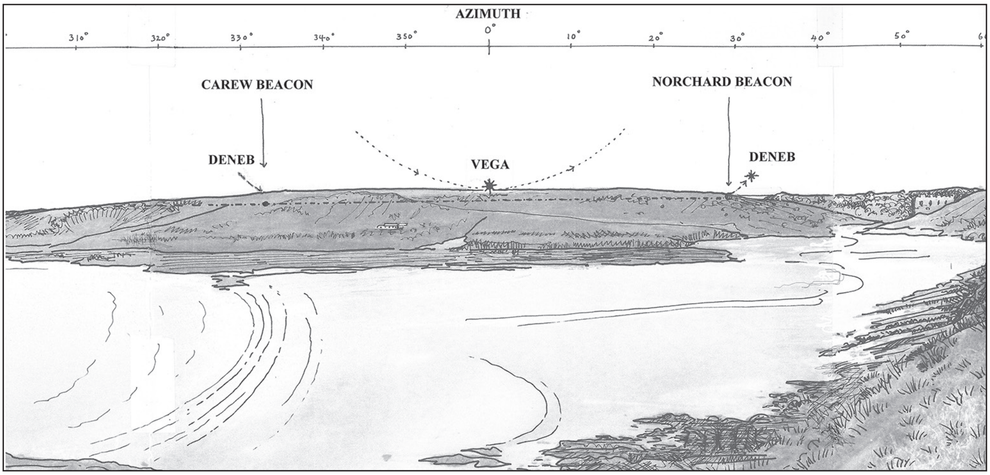

Fig. 9.6: A composite scale image of the horizon at the back of Manorbier Bay, as seen from the King's Quoit, showing the positions of Vega and Deneb during the Early Neolithic, 3800–3200 BC.

An observer standing on the headland at Manorbier at midnight on the winter solstice now would not be able to observe the same events. This is because of the phenomenon of precession, which causes the apparent position of the stars as viewed from Earth to shift cyclically over a period of 26,800 years.

Comparison of this observation with the work of others has been difficult because of a lack of reports of similar research in the published literature. Most of the recent astronomical studies relating to prehistoric monuments in the UK have concentrated on the cycles of the sun and moon (Ruggles 1996,1999; Heath 1998, 2009; Sims 2006, 2009). Also, few, if any, investigators seem to have considered the possible involvement of earth built constructions, such as mounds in astronomical alignments.

A small number of possible alignments to Deneb's prehistoric rising point have been hypothesised by Thom (1967, 104–5) who suggests that observations of Deneb are indicated by a NNE alignment at Avebury, as well as another at a stone circle at Ballantrae, and by the orientation of the Nine Maidens stone row near Bodmin in Cornwall. Somerville (1912) notes a due north alignment at Callanish, and Moore and Murphy (2006) have suggest that the NNE alignment of the passage of Fourknocks, a chambered monument which is part of the Boyne group, facilitated observations of the rising of Deneb in 2800 BC, at the time the monument was built. However, some of these alignments may be tenuous; many of Thom's results have been questioned by authors including Ruggles (1999) and Schaefer (1986), and Moore and Murphy's work is intended for the lay reader. More work certainly needs to be done in this area.

Discussion

At the end of this investigation, is the King's Quoit any less enigmatic? Or are there still more questions than answers? In terms of classifying and dating the dolmen, initially the author found the constructional similarities to the large Food Vessel cists persuasive, In

addition, the landscape setting is typical of the possibly late Neolithic, Early Bronze Age earthfast dolmens (Cummings 2002, 2004; Nash 2008). The alignments between the Quoit and the Early Bronze Age mounds and the rising and setting of Deneb could indicate that all the monuments were part of a single Early Bronze Age ritual complex. However, the earlier lower culmination of Vega across the nearer horizon, for which the Quoit may have been ideally placed as a viewing location, made this theory less convincing. It may rather be an example of long continued use and re-vision of a site, something which has been noted by many authors elsewhere.

As for meaning and purpose, if we accept that both Quoit and mounds were placed to facilitate viewing northern stellar events there are at least three possibilities.

There is a navigational argument. Davidson (1988) has suggested that at least some of the alignments found at prehistoric sites could have had a navigational purpose, and a traveller heading due north from Manorbier would cross the lower, western end of the Preseli hills to arrive at Newport bay, another sheltered harbour in Cardigan Bay, avoiding the rough water and strong currents around Strumble Head. Elsewhere, and earlier, Malville also suggests that a cluster of megaliths, studied by him in the southern Sahara, with multiple northern alignments, dating from possibly as early as 5000 BC, and certainly before 2800 BC, had a navigational element. There was no Pole Star as such during the prehistoric occupation of the area, yet an awareness of directionality would still have been important for nomadic Neolithic groups travelling across the Sahara (1998, 490).

Alternatively, or additionally, the stellar alignment could have been connected with myth or cosmology. Frank (1996) has identified a body of myth and folklore extending across Europe, into Siberia and North America concerning celestial bears, with fragments of tales also involving characters based on other, northern constellations. She hypothesises that this oral tradition could extend back into the Palaeolithic, especially as it occurs on both sides of the Bering Strait. Again, although there is no exact parallel with the Manorbier alignment involving Deneb and Vega there is evidence of a concern with the northern circumpolar stars.

There could also be a ritual purpose for the complex that is connected with death and transformation. Both dolmen and mounds can be seen as occupying liminal locations, which some writers (Tilley 1994, 2004; Turner 1969; Cummings 2002) have identified as likely ritual spaces.

Brady (2011) has analysed Pyramid Texts of the Old Kingdom of Egypt, dating from the mid to late third millennium, roughly contemporary with the Early Bronze Age of Atlantic Europe, which describe the recently deceased King as a star, as 'destined for the imperishable stars', 'rising using a celestial ladder, step by step'.

Whatever his method of ascent, his journey is always towards the celestial north, 'I ferry across in order that I may stand on the east side of the sky in its northern region among the Imperishable Stars, who stand at their staffs and sit at their East; I will stand among them...' (Brady 2011, 41).

Brady also considers that Vega is the 'Imperishable' star with which the King is identified. At this period in Egypt, it set for a few hours each night before rising again, far to the north of east, as Deneb did during the same period at Manorbier. Since the mounds at least have evidence of burial function (Deardon 1851), perhaps rituals were performed at the Quoit while Deneb set behind the western group, entered the underworld, and rose again through the eastern mounds.

Deneb is the brightest star in the constellation we now visualise as Cygnus, the swan. Hayden and Villenueve (2011) attest to the importance of stars to contemporary ‘complex’ hunter gatherers, although they found that many of them did not see the stars as grouped into constellations. Therefore it would be speculative to suggest that the Bronze Age inhabitants of Manorbier recognised constellations, perceived Cygnus as we do, or envisaged it as a swan. Nevertheless there is evidence that in the later Bronze Age swan imagery on material culture became increasingly common in relation to the movement of the sun, depicted as a wheel or disc, across the sky (Klontza-Jaklova 2010; Bevan, 1989). Deneb and Cygnus did rise before the sun in the pre-dawn sky, in November, around the time of Samhain, now conflated with Halloween, our modern festival of the dead. Also, some northern cultures, such as the Siberian Evenk and Tungu have a traditional association between swans and the transport of souls to an otherworld, which they envisage as being beyond the polar stars (Brazil 2003; Saunders 1995).

Returning to Manorbier, the contemporary name of the largest of the eastern mounds is Norchard Beacon, and the welsh for a swan is ‘yn alarch’ – which, if said gruffly to a 19th century English representative of the Ordnance Survey, might well be transcribed as Norchard.

More prosaically, the Quoit could have acted as a secluded viewing platform for a specialist elder or elders to determine, by astronomy, the most appropriate time to gather resources for solsticial feasting, or to travel to a gathering. Hayden and Villeneuve (2011) found that many of the socially ‘complex’ hunter gather societies they studied had specialists who engaged in solsticial observations, and sometimes also lunar and stellar observations, and did so to gain prestige and political advantage through the best possible timing.

Conclusion

This three-part approach to understanding prehistoric sites is still something of a work in progress. Nevertheless, landscape phenomenology applied to this Pembrokeshire dolmen shows that it has elements in common with other similar monuments located in steep, rocky, and or coastal areas of western Wales, which in turn have very different settings from mounds, henges, and ‘portal’ dolmens. Past archaeological investigation locally provides a chronological framework, although without excavation at the King’s Quoit itself we still cannot be sure of the date of construction.

The archaeoastronomy of the Quoit, and its apparent relationship to the Ridgeway mounds suggests that the builders were concerned with the apparent motion of Vega and the setting and rising of the circumpolar star Deneb. This may give additional insights to the meaning and purpose of the dolmen and the Ridgeway mounds.

The archaeoastronomical analysis gives added weight for an Early Bronze Age dating of the mounds, while the relationship between the height of the ledge on which the Quoit sits, the altitude of the near horizon at the back of the bay, and the transit of Vega during the 4th millennium BC, could infer that the dolmen occupies a site already known and used during the Neolithic.

All of these ideas are suggestions, and an attempt at a more holistic interpretation i.e. a fleshing of the bones combining an archaeology of landscape and skyscape.

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SkyMap Pro 11 – Astronomy software by Chris Marriott.

10

The View from Within: a ‘Time-Space-Action’ Approach to Megalithism in Central Portugal

Fabio Silva

The archaeological record of Northwest Iberia attests to a cluster of activity in the Neolithic period (Cruz 1995a). Megaliths dot the landscape from the northern Atlantic coast of Galicia to the platform of the *Mondego* river of central Portugal. The Central Massif, especially *Serra da Estrela* to the southeast of the *Mondego* platform, offers good pastures during the spring and summer seasons and has evidence of human presence since the fifth millennium BCE (Cruz 2001, 297). Shortly after this early Neolithic occupation, megalithic dolmens and tumuli began to be constructed and are especially concentrated around the most important rivers of the region.

Dolmens, or *antas* in the original Portuguese, are very simple monuments: they have a central polygonal chamber, made out of megalithic orthostats, typically seven, nine or eleven in this region of Iberia. The chamber might then have an entrance with or without

Fig. 10.1: Dolmen da Orca*, with extant cover-stones and tumulus. Despite being one of the biggest dolmens of the region its entrance is nevertheless quite small (bottom-right). Notice the eucalyptus trees that surround it today.*

a corridor, also megalithic in nature. Both the chamber and the corridor were roofed with cover-stones and the whole construction was surrounded by a tumulus: a mound, typically of earth, but covered with stone. At its prime, a typical dolmen would look like an artificial mound with a stone shell and a single opening (Fig. 10.1).

Passage graves, dolmens and other megaliths throughout the Atlantic façade of Europe are carefully positioned in relation to their landscape (Tilley 1994; Cummings 2009), but can also be oriented towards particular astronomical events (Ruggles 1999). The exploration of the skyscape complements that of the landscape and provides further insights into not just the ideologies and cosmologies of past societies, but also into their rituals and activities (see Introduction, this volume). This holistic approach to megalithism falls under what Darvill named a "time-space-action model" (Darvill 1999).

This chapter explores the location and orientation of the Neolithic dolmens of the *Mondego* platform using a methodology that borrows and integrates elements from landscape archaeology and archaeoastronomy. The view from within the dolmens highlights the importance of *Serra da Estrela*, the mountain range that contains the highest peak in continental Portugal, as well as the star Aldebaran that would rise in alignment with it. This leads to a discussion of the role of the brightest star of Taurus in the Neolithic cosmology, particularly its relationship with belief and ritual. This chapter both completes and complements a prior preliminary analysis carried out on a smaller sample of dolmens in the same region (Silva 2013).

The Neolithic of Central Portugal

Evidence for the occupation of central Portugal prior to the Neolithic is scarce but growing. To the northeast, in the *Côa* valley, famous for its Upper Palaeolithic open-air rock art sites, there is ample evidence for a continuous, though intermittent, Holocene occupation until the Early Neolithic (Monteiro-Rodrigues 2011; 2012). In *Oliveira do Bairro*, in the *Vouga* basin, and close to where the coastline would have been at the onset of the Holocene, microblade finds have been attributed to the Mesolithic, at about 6,500–5,500 BCE (Silva 2000). Based on these finds Cruz considers that the Mondego platform was not devoid of Mesolithic occupation but that these settlements would most likely now be submerged or destroyed by the rising water levels (Cruz 2001, 296).

The debate over the transition to the Neolithic has, as elsewhere in Atlantic Europe (Barker 2006, 325–381; Silva *et al.* 2013), revolved around two possible scenarios: that of colonization and that of acculturation. Zilhao (2001) proposes a 'Maritime Pioneer Colonisation' model according to which agricultural communities, formed by pioneer colonists, leap-frogged along the coast of the Mediterranean, eventually reaching the Portuguese coast. The north and interior of Portugal would have been populated quite late, as these Neolithic 'islands' developed, increased in size, and moved to occupy previously empty regions. Other scholars, however, highlight that communities on opposing sides of the transition shared similar landscape choices, settlement patterns, mobility and broad-spectrum subsistence strategies (Soares *et al.* 2003, 51). This suggests that Mesolithic communities adopted Neolithic traits and domesticates, becoming themselves Neolithic.

This discussion has so far been centred on the southwest coast, where the first Neolithic

communities appear. However, more recently, Monteiro-Rodrigues has looked at evidence from the Iberian northwest and the interior, particularly that stemming from the site of *Prazo*, in the *Côa* valley (Monteiro-Rodrigues 2011). This author suggests a much richer and complex process of Neolithization, involving 'selective assimilation' of Neolithic traits by different hunter-gatherer communities (Monteiro-Rodrigues 2011, 363–8). The Neolithic of interior regions of Portugal would thus spawn from earlier indigenous Mesolithic communities. This is not dissimilar to Tilley's 'structuration model' proposed to explain the Neolithic transition in southern Scandinavia (Tilley 1996, 108–9). Such 'continuity and transformation' models are capable of explaining the diversity that is present in the archaeological record locally while, at the same time, giving agency back to the hunter-gatherers themselves and not some wider geographical, climatic and/or evolutionary process (Silva *et al.* 2013).

Discoveries of the past twenty years, especially of Neolithic settlements in the *Mondego* basin, have allowed a picture of local life during the fifth millennium BCE, the Early Neolithic, to emerge (Senna-Martinez *et al.* 2008a, 318–9; Valera 1998). Pottery fragments attributed to this period show characteristics belonging to the traditions of the Early Neolithic from *Estremadura*, to the southwest, and *Andalusia*, to the southeast. Based on this, Senna-Martinez and Ventura (2008b, 80) suggest the possibility of a dual origin. However, considering the scarce but increasing evidence for pre-Neolithic occupation of the region, continuity cannot be discounted and the pottery evidence might simply indicate the existence of exchange networks with meridional communities.

The evidence indicates that small communities sustained themselves primarily by small game hunting and the gathering of acorns and other winter fruits. Agriculture would have played only a minor role in the subsistence of these communities, if at all (Senna-Martinez *et al.* 2008a, 327). On the other hand, the raising of ovicaprids, introduced to the region by the first Neolithic settlers, suggests that winters were spent on low grounds and the spring and summer seasons on the high pastures of *Serra da Estrela* (Senna-Martinez *et al.* 1997, 663–4; Cruz 2001, 313). Palynological and antracological evidence from *Serra da Estrela* indicates that from around 5,000 BCE there was "… general forest lightening, but with a few and scattered clearings" (Knaap *et al.* 1991). This has been interpreted as evidence of human impact on forest cover (Araújo *et al.* 2012), which is supported by its chronological coincidence with the onset of the Early Neolithic of the Mondego platform (Senna-Martinez *et al.* 2008a, 323). More recent and wider studies, however, suggest that both "human activity and climatic change may have collaborated to produce an unprecedented degradation of the landscape" (Martínez-Cortizas *et al.* 2009, 84). Nevertheless, incontrovertible evidence of human presence, in the form of Neolithic material culture, has been found at an elevation of 1430m (Cardoso *et al.* 2002).

The monumentalization of the landscape

Radiocarbon dates indicate that the first megaliths were built roughly a thousand years after the first Neolithic communities showed up in the region (Cruz 1995a). Senna-Martinez and Ventura (2008a, 333) suggest a division between Middle and Late Neolithic monuments. The first phase would be characterized by tumuli with a small megalithic polygonal chamber and a short corridor or none at all. Megaliths of the second phase would have been built during the Late Neolithic. These are generally bigger and possess developed corridors with heights that are different from those of the chambers and include more complex and differentiated

scenic spaces. Cruz, however, notes that it is difficult to establish a chronology for the small monuments and that, given the vast geographical regions considered, it is possible that megaliths of both sizes were being constructed and used contemporaneously by different communities (2001, 302). The general trend towards more and more complex monuments is nevertheless in line with arguments put forward for surrounding megalithic groups in Iberia (Cruz 2001, 302). On the other hand, "there is no evidence for the construction of dolmens" after 3,700 BCE, even though there is evidence for the continued use of some throughout the Late Neolithic and beyond (Cruz 1995a, 104).

Throughout the vast region and time period under consideration the depositional assemblages associated with these monuments are quite limited. Microliths, blades, polished stone axes and beads are universally present, whereas ceramic is notable for its absence, even though it shows up in other contexts (Cruz 2001, 305). Arrowheads are also found in the younger and more complex monuments of about 4,000 BCE onwards, in line with the introduction of this artefact into the Iberian northwest. The Late Neolithic is thus not so much characterized by new architectural styles but by the presence of new depositional artefacts, suggesting an increase in complexity of the funerary rites (Senna-Martinez 1994). New elements include novel pottery styles, projectile points, blade sickles and flint daggers, which are also found in known settlements that have been radiocarbon dated to the same period (Senna-Martinez 1994, 18).

Judging by the small quantity and variety of depositions and other artefactual finds, as well as the evidence for "condemnation structures" that permanently closed-off access to the dolmens, it seems that these monuments (both of the simple and complex types) had a relatively short lifespan (Cruz 2001, 290–1, 315–6). There is evidence for rituals involving fire in these 'condemnation' procedures, as well as care in the deposition of the stones that closed off the entrance, so that they would blend in with the surrounding tumulus, effectively camouflaging the dolmen's entrance.

These monuments can be seen as "true anchors in the landscape for populations that, on the other hand, have a high seasonal mobility" (Senna-Martinez *et al.* 2008b, 82). In this way Senna-Martinez and colleagues fit the monuments into their economic model: the megalithic cluster, by marking the winter territory, would legitimize its occupation. Settlements in the *Mondego* basin appear in close proximity to the dolmens and suggest an autumn and winter occupation, as evidenced by the presence of central hearths and earth ovens where acorns were roasted (Senna-Martinez and Ventura 2008a).

Megalithic archaeoastronomy of the region

The seasonal model found further support from the archaeoastronomical analysis of the orientation of the entrance of the dolmens conducted by Hoskin, as part of his larger Mediterranean survey (Hoskin 2001, Senna-Martinez *et al.* 1997). Hoskin split the dolmens of Central Portugal into two groups, one roughly comprising those that were located in the northern river basins of the *Vouga*, *Paiva*, *Torto* and *Côa* rivers, the other those of the *Mondego* basin. In order to measure their orientation, Hoskin defined a line "from the centre of the backstone [the stone opposite the chamber entrance] to the centre of the entrance or passage" (2001, 12), of which he then measured the azimuth by using a compass.

Hoskin was unable to find a distinct pattern that applied to all dolmens: they all seemed to have different orientations, although within a given azimuthal range. The measured

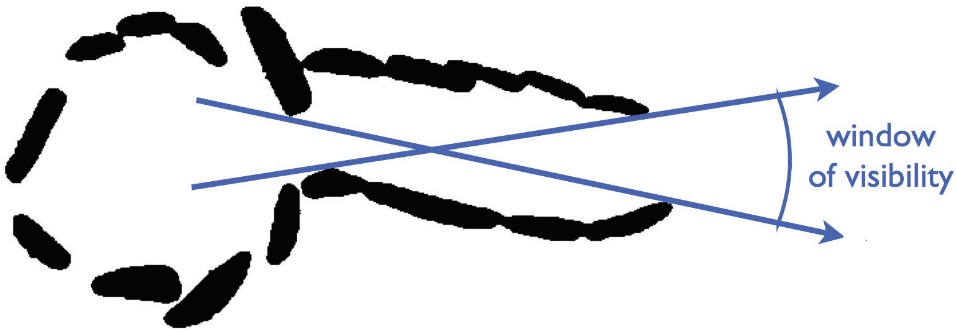

Fig. 10.2: Simplified plan view of a typical dolmen with corridor (orthostats in black), with the visibility window orientations measured (blue lines).

orientations were then interpreted as solar alignments to either sunrise or sun-climb (that is, to the sun shortly after sunrise) at the beginning of their construction. This would account for the variability in orientation but also for their confinement to a given range (as the sunrise position varies between a given minimum and maximum at the Solstices). For the *Mondego* dolmens, which exhibit a preference for south-easterly orientations and thus for autumn/winter sunrises, this seemed to fit the seasonal model of the archaeologists. Dolmens in other basins, however, exhibit a preference for slightly north-of-east directions, which can only fit an early spring/late summer sun (Silva 2010). In both groups, outlier orientations that cannot be explained by Hoskin's generalized solar interpretation abound which prompted the present author to conduct a more comprehensive survey of the region.

Fieldwork for the on-going project started in the spring of 2010 and focused, in its first phase, on the region between the *Douro* and *Mondego* rivers (Silva 2010). The goal was not only to expand on the number of sites surveyed by Hoskin, by including newly excavated sites, but also to extend the employed methodology.

Not only was a general orientation measured, similar to that defined by Hoskin, but also a measure of what I have named the "window of visibility" – see Silva (2013; 2014) for in-depth discussions of the employed methodology. The latter is defined as the maximum extent of the horizon which, given the dolmen's corridor and entrance geometry, can be seen from the chamber (Fig. 10.2). Contrary to, say, the ancient Egyptian pyramids, the dolmens very rarely display straight lines, even in the corridors, due to the use of very rough orthostats. As a result of this, one can define as many straight lines as methodologies to measure them. Measuring one of these lines to as much precision as one can does not counter the fact that one cannot be sure whether one is measuring the "right" line or whether such a line was meaningful to the dolmen builders. The latter might have intended the orientation of the chambers to simply point out, indicate or direct one's gaze towards a broad area of the horizon, where an "obvious" topographical feature would mark the important astronomical event.

This visibility window methodology was only applied to dolmens with a corridor, as only these considerably constrain visibility. In one case, the archaeological plan was used to carefully abstract these measurements, as the site did not provide enough conditions to do the required field measurements. For the simpler dolmens, only a very rough entrance

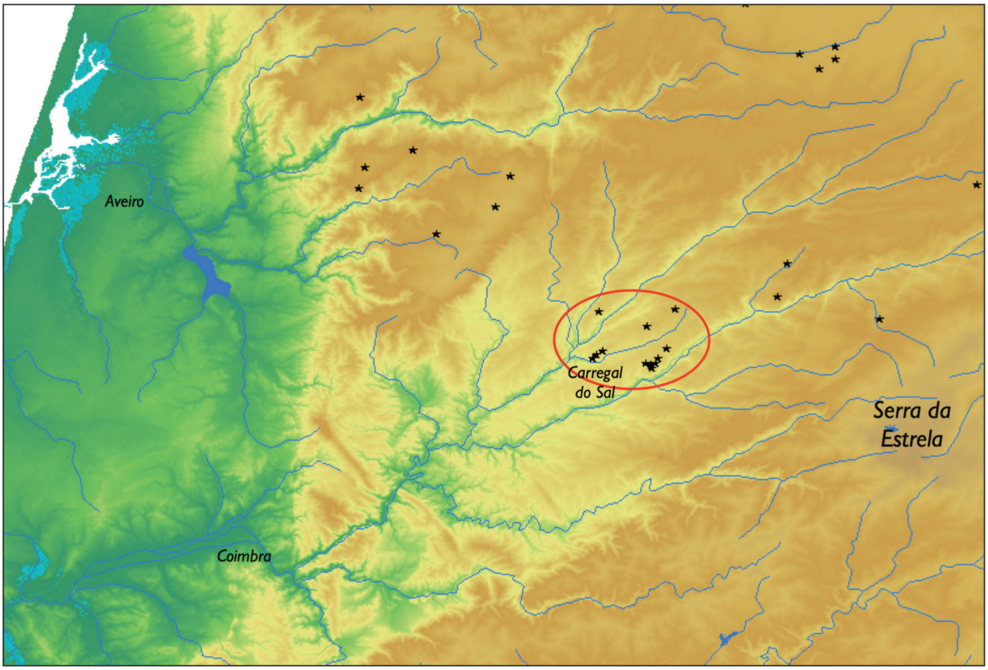

Fig. 10.3: Map of the Mondego *platform with key locations named. The black stars represent the location of dolmens surveyed as part of this on-going project. The cluster that is being analysed in this chapter is highlighted by the red circle.*

orientation was measured, as a considerably broader range of the horizon would be visible from within these. This measurement is not used in this work, although see Silva (2010; 2013), and should be seen as merely indicative, since it is still not clear how access to these dolmens was maintained. Some archaeologists suggest that, at least in a few such cases in North Portugal, access was via a ramp in the surrounding mound (Cruz, personal communication), which would constrain the view from the dolmen's chamber in a way that is impossible to reconstruct.

The methodology developed in the course of this project provides a more phenomenological approach to archaeoastronomy, allowing the portion of the horizon that is visible from within the chamber to speak for itself. When employed, patterns not observable in the milieu of possible statistical analyses were brought to the fore, particularly when looking at archaeologically significant scales (Silva 2014). This mesoscopic approach was initiated by looking at one of the best-preserved megalithic clusters of the region.

The *Carregal do Sal* Cluster

The district of *Carregal do Sal* is located on the northern bank of the *Mondego* valley, a mere kilometre and a half from the riverbed (Fig. 10.3). The archaeological record starts with the Early Neolithic settlement of *Carriceiras*, discovered in 1991 (Senna-Martinez *et*

Table 10.1: Window of visibility measurement of surveyed dolmens in the Mondego *platform.*

Ref	Name	Window Max Az	Window Min Az	Notes
23	Orca das Pramelas	130.00º	78.00 º	
24	Orca de St Tisco	141.50º	93.00º	
25	Orca do Outeiro do Rato	124.25º	74.25º	
26	Orca do Santo	112.00º	85.00º	
27	Dolmen da Orca	117.50º	98.50º	
28	Orca 1 do Ameal	-	-	Simple dolmen, without corridor
29	Orca 2 do Ameal	-	-	Simple dolmen, without corridor
30	Orca da Palheira	-	-	Window impossible to measure
36	Orquinha da Víbora	-	-	Tumulus, possibly Bronze Age
42	Orca 2 de Oliveira do Conde	125.21º	80.42º	Measured from archaeological plan
51	Anta da Arquinha da Moura	111.00º	91.00º	
52	Orca de Travanca	-	-	Simple dolmen, destroyed
53	Orca de Valongo	-	-	Simple dolmen, destroyed

al. 1994). Since then, several others have been identified in the area: among them three open-air settlements and four rock-shelter settlements (Senna-Martinez *et al.* 2008a, 319). In addition, material recovered at the tumulus of *Orca 2 do Ameal* originated from an earlier settlement in the same location (Ventura 1998). The same was later confirmed for *Orca 2 de Oliveira do Conde* (Ventura 2000) and *Orca do Folhadal* (Senna-Martinez *et al*. 1999).

In the Middle Neolithic the region became home to several megalithic structures, of both the simple and the complex varieties. Table 10.1 lists all surveyed monuments in the region. Most are located in the *Fiais/Azenha* cluster, but others are found throughout the territorial municipality. A visibility window for *Orca da Palheira* was impossible to measure as a rural house was built around the dolmen using some of its orthostats. In addition, the extant corridor seems to have been slightly rotated in the process (Ventura, personal communication). Although technically not in the *Carregal do Sal* municipality, the monument *Anta da Arquinha da Moura* is included in this analysis for its similarities in proximity, landscape and skyscape. It also illustrates the potential that the findings are extendable to the wider lower Mondego platform. Similarly, the tumulus of *Orquinha da Víbora* most likely never concealed a megalithic dolmen and might date to the Bronze Age (Vilaça *et al.* 1999), but its location, landscape and horizon are in every way similar to the dolmens in this cluster, which might indicate a continuity of practices in this region.

The region continued to be occupied throughout the fourth millennium, as evidenced by the settlements of *Ameal-VI*, *Murganho 2* and *Quinta Nova* (Senna-Martinez *et al.* 2008a, 340–2). These settlements are in everything similar to Early Neolithic ones, albeit structurally more complex. Radiocarbon dates, however, locate them firmly in the Late Neolithic/Chalcolithic (Senna-Martinez *et al.* 2008a, 333).

When it comes to choice of landscape, it seems that there was a thread of continuity throughout the Neolithic. Settlements are found in open locations, with slight slopes and good visibility towards the east (Senna-Martinez *et al.* 2008a, 323). Much the same can be said of the megalithic structures. In fact the thread of continuity is very clear in the cases of the dolmens, mentioned above, that were built on top of Early Neolithic settlements, as well as of the Late Neolithic settlements that are preferentially located in the vicinity of megaliths.

Dolmenic Landscapes

The aspect I'm most interested in is what phenomenologically one would call *the view* or, in other words, the extent of landscape visible from a given site, as well as the horizon formed by the most distant topographic features (Cummings 2001; 2009). Unfortunately in the *Carregal do Sal* area, and more broadly in the *Mondego* platform, dolmens are found deep in wooded areas. The forests are, actually, quite recent. In fact, it was when these eucalyptus trees were being planted that most sites were identified for the first time (Ventura 1993).

Vegetation cover during the Neolithic would have been very different. Studies done on northwest Iberia have pointed to a "deforested landscape heavily affected by humans, with high abundance of shrubs and ferns", especially on the interior (Martínez-Cortizas *et al.* 2009, 84; Kaal *et al.* 2011; Araújo *et al.* 2012). Further to this, there is evidence that prior to the construction of a dolmen, the sites were cleared of any vegetation, probably through fire (Ventura 1998, 124). Since in most cases the area surrounding the dolmen has not been fully excavated, the full extent of such clearance procedures is unknown. However, due to the existence of forecourts immediately outside the entrance, it could have been far-reaching.

Unfortunately, today's eucalyptus trees prevent one from enjoying *the view* from most dolmens in the region under study. To work around this, one can use Digital Elevation Models to virtually reconstruct the surrounding landscape in the absence of any vegetation. A Digital Elevation Model is a computer model composed of a raster of cells where each has the value of the mean elevation across the area defined by that cell (Connoly and Lake 2006, 27). There are several DEM models around, using elevation data acquired and treated differently. One such case is the SRTM or Shuttle Radar Topography Mission, which comprises elevations determined every 300 feet, outside of the US, obtained via radar interferometry by the Space Shuttle program during February 2000 (US Geological Survey 2010).

With this data a GIS software package can be used to create a virtual reconstruction of the horizon profile at any location. HeyWhatsThat is a free, online utility that uses SRTM data to do this (Kosowsky 2013). Figure 10.4 shows a 360-degree panorama of *the view* around *Anta da Arquinha da Moura*, as reconstructed using HeyWhatsThat. The different colours represent different distances of the topographical features (green is closest, then blue, dark magenta and finally purple). The vertical scale has been exaggerated 8 times to facilitate the identification of topographic features and the small inverted triangles, in red, mark visible named peaks. The cardinal directions are also marked.

The view from *Anta da Arquinha da Moura* is extensive, with mountain ranges in the distance creating a rugged horizon. The most prominent of these is the *Serra da Estrela* mountain range, towards the east/south-east. Most dolmens in the region under study are located in landscapes that yield similar views and horizons. The only exceptions seem to be *Orca da Palheira* and *Orca 2 de Oliveira do Conde*, both complex monuments with corridor that are four hundred metres distant from each other, which have a local horizon obscuring the view, as previously reported by Silva (2013, 107). When the site elevation given by the Digital Elevation Model is corrected, based on more accurate GPS readings and direct comparison to topographic charts, the reconstructed horizon displays a single feature towards the east: *Serra da Estrela*. This peculiarity occurs for both sites and will be returned to in the next section.

The importance of *Serra da Estrela* for the local Neolithic communities has been mentioned above and it is very interesting that this very same mountain range is featured

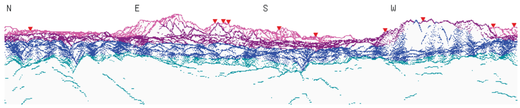

Fig. 10.4: The view from Anta da Arquinha da Moura*, reconstructed using a Digital Elevation Model. Horizon images are copyright 2013 Michael Kosowsky. Used with permission.*

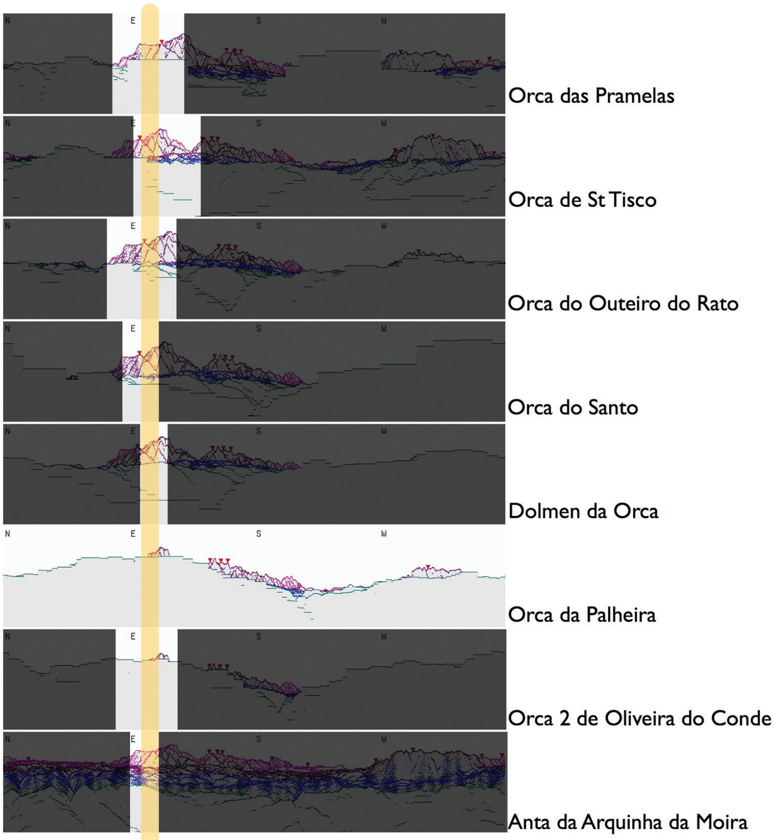

Fig. 10.5: The view from all surveyed corridor dolmens, reconstructed using a Digital Elevation Model. What cannot be seen from within the dolmen's chamber has been greyed out, thus highlighting the window of visibility. The vertical orange ribbon marks the region of the horizon that is visible from within all dolmens. Horizon images are copyright 2013 Michael Kosowsky. Used with permission.

so conspicuously in the landscapes of these communities. The significance of topographic features for Mesolithic and Neolithic folk has been highlighted by Tilley (1994). He argued that, in the Mesolithic 'known, named and significant places [were] linked by paths of movement to which populations repeatedly returned during their seasonal activity rounds' (1994, 202). In the Neolithic this dynamic would have changed, as the megaliths became

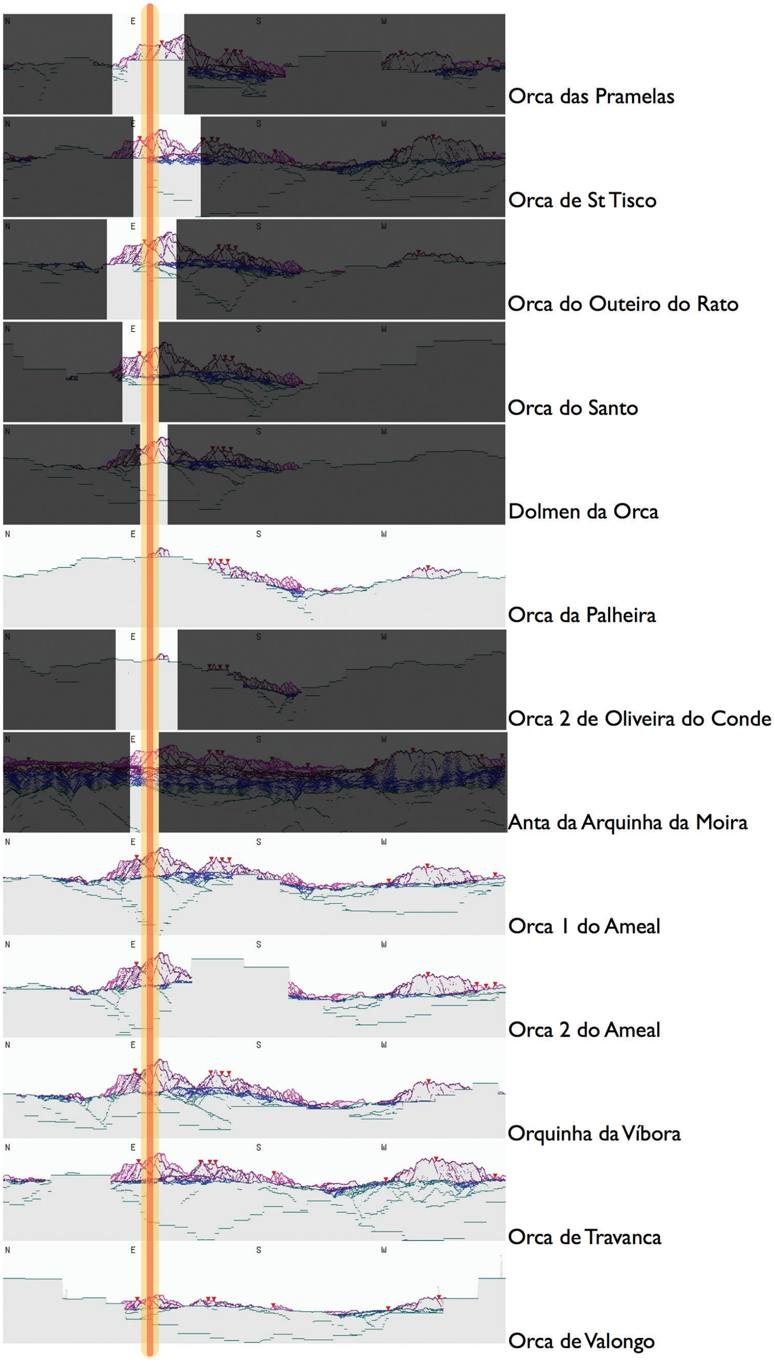

Fig. 10.6: The view from all surveyed dolmens in the Mondego platform. The vertical red ribbon marks the location from where the star Aldebaran would have risen from 4,300–3,700 BCE, directly above Serra da Estrela. *The vertical orange ribbon is the same as in Figure 10.5.*

the anchors of the seasonal movements. Important landscape points 'became *captured in the orientation* of morphological features of the monuments and *their placement in the landscape*' (1994, 202–3, my emphasis).

One can use the measured visibility windows to check whether *Serra da Estrela* is not only prominent in the megalithic landscape but also, in Tilley's words, 'captured in the orientation' of the dolmens. Figure 10.5 shows the reconstructed panoramas for all dolmens with corridor, with the window of visibility overlaid: the extent of the horizon that is not visible from within the chamber has been greyed out.

The telescopic corridors of the *Mondego* platform dolmens are all oriented towards *Serra da Estrela*, further highlighting its role in the cosmology of these communities, and even suggesting a link between the function of the dolmens and the mountain range. In fact this is readily extendable to the simpler dolmens that have no corridor but which, nevertheless are roughly oriented towards the mountain range (Fig. 10.6).

Besides having potential ritual and funerary functions, the dolmens of the *Mondego* valley also marked the winter territories of their builders (Cruz 2001, 311; Senna-Martinez *et al.* 2008b, 82), whereas *Serra da Estrela*, in the horizon, marked their summer pastures (Senna-Martinez *et al.* 2008a, 332). Consequently, it seems that both man-made and natural landscape markers were anchoring the seasonal movement of these Neolithic communities. Thus the orientation of the *Carregal do Sal* dolmens, makes sense from a landscape perspective.

Megalithic Skyscapes

The prominence of *Serra da Estrela* in the megalithic landscapes under study has just been discussed. However, this particular mountain range is visible from a wide range of locations in north-central Portugal, in some cases being a much more prominent horizon feature than when seen from *Carregal do Sal*. Yet, this region yields a higher density of megalithic sites than, for instance, the Upper *Mondego* region, where there are fewer megaliths and where they tend to appear in isolation. This could be a matter of archaeological sampling and survival rates, in other words that the region under study has been more thoroughly surveyed and thus more Neolithic structures have been found. On the other hand, it is possible that this region was chosen by the Neolithic communities not simply because *Serra da Estrela* was visible from it but also for other reasons. One suggestion I'd like to entertain is that this mountain range acted as a foresight for an astronomical event of importance to these Neolithic communities.

The exploration of the horizons surrounding the *Carregal do Sal* dolmens allows one to consider the possibility of astronomical intentionality behind the orientation of these dolmens. The horizon is where the heavens meet the earth, where landscape meets the skyscape, and therefore, where landscape archaeology and archaeoastronomy overlap. Let us look at the extent of the horizon that is visible from within the chambers of all dolmens with corridor in *Carregal do Sal*. If one of the many directions in this range was of astronomical importance to the dolmen builders then one would expect this direction to be visible from within all dolmen chambers. This is to say that a pattern should emerge from the study of the horizon. Figure 10.5 highlights in orange the range of azimuths that are visible from the chambers of all corridor dolmens. The highlighted region does not include the peak of the mountain range (which is not visible from several dolmens) and is most constrained by the two most

impressive monuments: *Dolmen da Orca* and *Anta da Arquinha da Moura*. Curiously, in the cases of *Orca da Palheira* and *Orca 2 de Oliveira do Conde* this region matches the bit of the horizon where the local landscape meets the distant mountain range. This might explain why these two monuments were built in this location, as it would have been quite easy to target that region of the horizon.

The highlighted region corresponds to azimuth range 98–111º. There are no well-established and visually well-defined solar or lunar events around this part of the horizon. The solstitial sunrises, when the position of sunrise is seen to stand still for about a week in midsummer and midwinter, occur further north and south respectively, and of the traditional lunar targets only one of the equinoctial full moons occurs close to this azimuth range at about 90–100º depending on the altitude of the horizon (Silva and Pimenta 2012). Another possibility is for sun- or moon-rise on an arbitrary date. Since the moon's movement is very erratic and difficult to predict and pinpoint with accuracy, this seems to be less likely, but the sun could be seen to rise in the highlighted region around the 20th of February and the 23rd of October every year.

The pinpointing of the sun's position on the horizon on a seemingly arbitrary date is not without precedent. The Hopi horizon calendars are a good example of a developed application of the same principle and its usefulness for an agricultural community (McCluskey 1977). The Neolithic communities could likewise have used this observation as a temporal marker for the coming of spring. However, there was another astronomical event in this region of the sky that might have served as a better trigger for the seasonal movement to higher pastures: the heliacal rising of Aldebaran, the brightest star of Taurus, and one of the brightest stars in the night-sky.

At the time of dolmen construction, circa 4,300–3,700 BCE, Aldebaran would have risen exactly within the band of the horizon that is visible from within all corridor dolmens. Figure 10.6 shows this band, marked by the thin vertical red ribbon, not only for the corridor dolmens, but also for the simpler ones. Although the architecture of these did not feature a corridor that would focus attention on a narrow band of the horizon, Neolithic folk might still have observed the rising of Aldebaran from these simpler dolmens. We can now also look back at the peculiar landscapes of *Orca da Palheira* and *Orca 2 de Oliveira do Conde*, from where *Serra da Estrela* is barely visible, and notice that Aldebaran would have risen exactly where the distant mountain range meets the local horizon.

Even though stars, whenever visible, are always seen to rise in the same place on the horizon throughout the year, stars that lie this far from the celestial pole go through a period in which they are not seen in the night-sky. After this period of invisibility, their first appearance is at dawn, rising just before the sun: this is what is known as the heliacal rising (Schaefer 1987; Brady this volume). In the epoch under consideration, the heliacal rising of Aldebaran happened around 18–27th of April (Silva 2013). The precision of these dates needs to be taken with a pinch of salt, as visibility, climatic and other observational criteria might not permit the star to be seen so close to the horizon on a given day. Generally, however, one can say that Aldebaran first appeared in the eastern sky in late April/early May.

The seasonal model states that, in the spring and summer, the dolmen builders would take their ovicaprids to the high pastures of *Serra da Estrela* to take advantage of its grazing grounds. If these Neolithic communities were observing the heliacal rise of Aldebaran, as the dolmenic alignments suggest and is here proposed, they could have used it as a temporal

Fig. 10.7: The view towards the east from Orquinha da Víbora*, at dawn at the end of April around 4,000 BCE, as reconstructed using a Digital Elevation Model and Stellarium. Aldebaran, the last star to rise before the sun, is seen to rise directly above the "mountain range of the star".*

Fig. 10.8: Very vivid extant red ochre paintings of Dolmen de Antelas (Oliveira do Bairro)*.*

marker for this movement to high pastures. Aldebaran's period of invisibility – from late February to late April – would provide the perfect amount of time to make preparations for whatever rituals were going to be enacted at the dolmens, as well as to prepare for the move to higher grounds.[1]

The Role of Aldebaran in Neolithic Cosmology

The question now is what role would Aldebaran have played in the beliefs of these megalith builders. The possibility that the helical rising of Aldebaran could have been used as a temporal marker for the seasonal movement of the Neolithic communities of central Portugal has just been highlighted. Yet, the heliacal rising of a star can be observed without the need to build any tools or structures. As an example, tribes in the Amazon celebrate the heliacal rising of the Pleiades as the transition from the dry to the wet season without building any monuments aligned to this event (Lévi-Strauss 1969, Hugh-Jones 1988). Much like the Amazonians, however, this seasonal function of Aldebaran would certainly mean that it would have played a key role in the cosmology of the Neolithic folk of central Portugal. Social memory of the importance of this star might have survived down to present-day in toponymical folktales of *Serra da Estrela*, which translates as Star mountain range (Silva 2013). However, this does not mean that observing the heliacal rising of the brightest star of Taurus was the intention behind the alignment of the *Carregal do Sal* dolmens: the heliacal rising is, after all, only the first observed rising of the star.

Aldebaran could be seen to rise in alignment with *Serra da Estrela* on any given night from its heliacal rising in late April to its achronycal setting in mid September (when it stops to be seen to rise during the night) and, throughout this breadth of time the dolmenic alignments would have been visible. However, since the dolmen builders spent the warmer months in the high pastures of *Serra da Estrela* they could not always observe the star rise from the location of the dolmens. This leaves us with two possibilities that should be equally considered: either the alignment was observed just before the seasonal move, and thus at the moment of heliacal rising; or the alignment was not meant for the living.

The former hypothesis implies that the moment of heliacal rising was indeed of importance. The latter, on the other hand, suggests a connection between the dead in the tomb's chamber and the star, which could be either symbolic (and ever-present) and/or ritual (and thus timed). These possibilities are not mutually exclusive as the connection between the dead and Aldebaran might be established at the time of the heliacal rising through the enactment of funerary rites. In the following these possibilities will be explored separately, with recourse to ethnographic and historical analogy whenever possible.

Aldebaran for the dead

Aldebaran could have been regarded as the heavenly abode of the dead ancestors, or their escort towards the afterlife. The dolmen's corridor and entrance could serve as a conduit for the dead soul to be transported to the horizon and henceforth to the sky with the assistance of Aldebaran. This could occur at any point during the warmer months, or it could be "triggered" by funerary rites timed by the heliacal rising of the star in late April. In many ways, this could be similar to ancient Egyptian beliefs in the afterlife, particularly during the Old Kingdom (Brady 2012; Faulkner 1966).

Another possibility is that Aldebaran was to take care of the dead buried in the chamber, while the living were away from them during the summer months. There could also be an element of territoriality in this, in that the personified star would, by doing this, keep an eye on their territory. But, perhaps more simply, the star was meant to serve as a beacon to the dead ancestors, marking the location of the living, who had gone to *Serra da Estrela* during

the warm months. In this way the ancestors could protect the living or ensure the natural fertility of the mountain range in the summer half of the year. On the other hand it might have simply been a case of ensuring that the seasonality that defined Neolithic existence in life was continued in the afterlife. The dead ancestors would use the stellar beacon to join their living relatives and descendants in the high pastures of the mountain range.

However intriguing these possibilities might be, particularly since they touch the otherwise intangible afterlife ideologies of long-gone communities, they are based on the assumption that the dolmens were tombs. This has been the default assumption of archaeologists both locally and elsewhere in Atlantic Europe. However, the evidence for this is scarce, particularly so in northwest Iberia.

In the Mondego platform human bones associated with Neolithic sites have only been found on one site: *Anta da Arquinha da Moura*, one of the dolmens considered in this study (Silva 1995). However, these are the result of inhumations during a later reuse of the dolmen (Bettencourt 2010; Cunha 1995). Although Calcolithic and Bronze Age folk reused many dolmens, a practice that was common in northwest Iberia, it is clear that they were unaware of its original purpose or design (Cruz 1995a, 104): they clearly identified the site, probably from the tumulus or any extant coverstones, but they didn't know where its entrance was supposed to be. Instead they dug the tumulus from seemingly random directions, eventually finding the corridor or chamber, removing some of its orthostats to get in, and then reused it for inhumations.

The lack of bone evidence in north Portugal is usually attributed to the effect of its acidic soils. Acid dissolves the mineral in the bones, which means that interred human bones do not survive for long in acidic soils (Silva 1995, 141–2). This could very well be the case, however, this should be treated less as a dogma and more as a working hypothesis that should be constantly tested. The restraining effect of long-held assumptions on the understanding of prehistoric archaeological remains is not without precedent (Monteiro-Rodrigues 2011; Silva *et al.* 2013).

Aldebaran for the living

An alternative hypothesis is that the dolmens were built primarily as temples, and only secondarily served as tombs, if at all. Although these are Neolithic monuments, agriculture played a very minor role for these communities: it was one form of subsistence among a broad spectrum of strategies that mostly focused on hunting and gathering. One should thus shed one's "agricultural thinking" (Gamble *et al.* 2005) when trying to understand these communities (Silva *et al.* 2013). They were essentially hunter-gatherers and, using ethnographic analogy as a proxy, ceremonial feasts and initiation rites should have played a major role in their social lives (Hayden *et al.* 2011).

The evidence for ceremonies at these sites is overwhelming, particularly in the forecourt immediately outside the dolmen's entrances. These forecourts seem to be a widespread feature of the dolmens of northwest Iberia, particularly of the more complex ones, and have been interpreted as "scenic spaces" (Senna-Martinez *et al.* 1999). These areas were clearly demarcated and, when excavated, provided a wealth of material culture (Carvalho 2005, 171–2). Their purpose is unclear but they have been interpreted as ritual in function.

Judging by the number of extant cases of megalithic art in the chamber's orthostats, of both the painted and the carved variety, it stands to reason that they might also have played

a role in whatever rituals were enacted there. Paintings of this nature, depicting hunting scenes but also more abstract or symbolic elements, are characteristic of hunter-gatherer rock art (Lewis-Williams and Pearce 2009). It has been suggested that these are associated with shamanism but also with initiation and puberty rituals or, more generally, with rites of passage (Lewis-Williams 1981; Power 2004; Solomon 1992).

Such rites '*accompany every change of place, state, social position and age*' (Turner 1967, 47) and, in general, share some characteristics that have been first identified by Van Gennep (Van Gennep 1960). They consist of three succeeding phases: 1) separation, when the initiate is separated from the community; 2) transition or liminality, which is the period of transformation; and 3) reintegration, during which the initiate is reincorporated into the community in a new role. Turner's work (1967) has emphasized the transformative aspects of liminality, when the initiate is separated from society. Further to this and based on an ethnographic survey of several groups, Hayden and Villeneuve highlighted the role of astronomy in initiation rites of hunter-gatherer secret societies, whose secret knowledge often "encompassed sophisticated solar, lunar and other celestial observations and knowledge" (2011, 348).

The dolmen's chamber could have acted as an initiation "womb": the young initiate would separate from the community, spend the night in the dolmen, maybe in a solitary vision quest that would culminate in Aldebaran rising just before sunrise. It is possible that the telescope-like feature of the corridor, by narrowing the band of the horizon visible from inside, would bar the dawn's twilight sufficiently for Aldebaran to be seen to heliacally rise days, if not a full week, ahead of any communal observation. Despite being purely conjectural, but phenomenologically testable, this would fit the view that hunter-gatherer "secret societies frequently appropriate parts of pre-existing ideologies but add new esoteric elements which normally form the 'secrets' known only to secret-society members." (Hayden *et al.* 2011, 346).

These factors do seem to suggest, and even highlight, the dolmen's possible use as an initiation structure. This is not necessarily to the exclusion of a funerary function: both could be associated in the ideology of the Neolithic communities. In fact, initiation is often conceived of as a new birth: a symbolic and social death-and-rebirth (Turner 1967, 48). Furthermore ritual, "especially certain forms which occur among secret societies, did not occur in isolation from behaviours such as feasting and dances" (Hayden *et al.* 2011, 351) which could be funerary in function (Hayden 2001, 37). What raising this hypothesis does is provide a new way to conceptualize and approach the phenomena of megalithism in northwest Iberia, one that has so far been overshadowed by the mortuary supposition.

Conclusion

Using a methodology that does not impose a straight line of orientation from the get-go, nor assumes precision in the alignment, but instead adds a pinch of phenomenology, the prehistoric monuments and landscapes of north-central Portugal were allowed to speak for themselves.

The view from within the chambers of all studied dolmens not only features *Serra da Estrela* in the horizon, but would also permit the rising of Aldebaran to be seen. Around

4,000 BCE, when the megaliths were built, the rising of Aldebaran could only be seen between late April and mid September. Because of their seasonal lifestyle, the Neolithic communities of the *Mondego* platform would spend the warmer half of the year in the high pastures of *Serra da Estrela* and not in the river valleys where the dolmens are located. They therefore could not observe the alignment between star, mountain range and megalithic corridors, unless this observation was done before they moved out of the platform. These communities could use Aldebaran's first rise in late April, after two months of invisibility, as a trigger for this seasonal movement.

However, everyone can observe the heliacal rising of a star without the need for any tools or structures. Aldebaran could have featured prominently in the cosmology of these Neolithic folk, but the purpose of the dolmenic alignments was not simply to observe its rising. This realization opens up new questions related to the use of these megalithic structures.

One possibility is that the alignment between star and mountain range was meant for the dead buried in the dolmen's chamber. This might link Aldebaran with a concept of afterlife, which is not without historical precedent. The star could be conceptualized as the land of the dead in the celestial skyscape, or as a conduit to such a land. On the other hand, it could serve as a beacon to ensure that the seasonality, between river valley and mountain range, that defined them in life continued in death. Funerary rites occurring at the heliacal rising of Aldebaran could trigger this link between the star and the dead, which continued for as long as the star was seen to rise in alignment with the dolmen's chamber. The hypotheses are many and varied, and constrained only by the limitations of ethnographic or historical analogy, and the imagination of the scholar.

The discussion has also allowed a new suggestion to be raised, namely that the dolmens were used as initiation structures and that the alignments played a role in these rites. This is certainly highlighted by other characteristics of the dolmens: the chamber's isolation, the lavish paintings found within in the style of shamanistic or initiatory rock art and the scant amount of depositions within. As part of the rite of passage, an initiate might be asked to spend one, or more, nights inside the dolmen's chamber in seclusion. This could be part of a vision quest, which would be boosted by the paintings inside the chamber. The vision quest might culminate in the observation of the heliacal rising of Aldebaran that, because of the telescopic nature of the dolmens' corridor, might have been visible days before any communal observation. This is not necessarily to the exclusion of previous hypotheses, as initiation and death could be conceptually linked in the Neolithic mind, and the dolmens might have served more than one purpose, as others have already proposed (e.g. Cruz 1995b).

The dolmens of the *Mondego* platform were therefore more than mere territorial markers or tombs, they were the very materialization of liminality: half-way between summer and winter, low ground and high ground, the river valley and the mountain range, night and day, nature and culture, society and the individual, maybe even the living and the dead or the uninitiated and the initiated.

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Note

1 In a prior work, both Aldebaran and Betelgeuse, in the constellation of Orion, have been identified as possible candidates for this alignment. However, the late heliacal rising of Betelgeuse, a month after Aldebaran's, makes it a less likely candidate, as already pointed out (Silva 2013).

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11

Afterword: Dances Beneath a Diamond Sky

Timothy Darvill

If, as Jimi Hendrix once suggested, we could kiss the sky, how would it feel? How would it taste? And what sounds would we hear? Such questions may seem irrelevant in the modern scientific world because space-science has mathematically modelled the infinite nature of the universe and has made great strides in documenting the content and texture of the nothingness beyond earth's atmosphere in the sky above our heads. But to societies without insights from such research these questions are very real, and often rather significant to their well-being. Traditionally, they were answered not by positivist Enlightenment understandings but by native science, complex cosmologies, mythological narratives, and beliefs systems that informed world views and gave structure and meaning to established ways of life. Standing on the highest available mountain was the nearest most people in ancient societies ever got to kissing the sky, although their monuments and material culture, both tangible and intangible, may have provided working models of the universe that substituted for the reality and made sense of the unknown.

As the papers in this book clearly show, the heavens comprise much more than the sun, moon, and stars in the night sky. People did much more than dance beneath a diamond sky. Time and again the contributors show how skyscapes are as much a part of the lived-in, experienced, and socially constructed world as the landscapes below our feet, the seascapes lapping our shores, and the taskscapes that structure the rhythm of everyday life. Their work shows how important it is to look up from archaeological features in the ground to contemplate the sky above and to consider how such a changing infinity was viewed and understood by ancient communities. What is visible in the sky by day or night relates closely to the construction and use of material culture in its widest sense. As Brown emphasises, this is also a topic that interests contemporary society, and as such we ignore it at our peril. The challenge to doing this well is developing robust theoretical concepts and solid useful tools in order to approach such questions without dragging in too much baggage from twentieth and twenty-first century ways of being.

First and foremost, the essays in this volume expand the universe that is archaeoastronomy into new domains. They build on existing traditions rather than sweeping them away, foregrounding essentially post-processualist thinking about the way people construct the worlds in which they live and thereby give an expanded vision of the social use of space. The introductory chapters by Silva, Campion, and Henty provide three rather different

perspectives on the way archaeoastronomy developed through the twentieth century and how the broader concept of 'skyscapes' might find application. All three recognize the universal importance of the sky, the potential for multi-disciplinary approaches, and the limitations of what is essentially descriptive geometry when it comes to analysing sites. But all three dance around a tricky theoretical problem that kicks in even before leaving first base: the post-processualist desire to dismantle the nature::culture dualism and its Cartesian implications. Until very recently, people could not change, restructure, or modify the skyscape in the same way that they could the landscape, but that does not mean they did not bring the sky into the domain of the cultural. Leaving aside the purely philosophical conundrum that a state of nature cannot logically exist because any humanly constructed categorization of the experienced world (including what we might chose to term 'natural') must be packaged as a socially meaningful item in order to be shared. Thus such items only exist within the realm of the cultural. However, a solution may be found in the way skyscapes are enculturated or given meaning. Whereas the landscape is physically appropriated through modification and thereby turned into a dimension of tangible material culture, skyscapes by contrast are metaphysically appropriated through projection whereby intangible material culture is mapped onto the heavens. In amongst these debates, and arising from the papers presented here, there are three things I would like to touch on by way of an afterword commentary: the significance of cosmologies; pattern and purpose; and the perspective of time-depth.

Significance of Cosmologies

No matter how much importance we attach to what the editors of this book refer to as 'skyscapes', it is important to contextualise this dimension of lived-in experience with the recognition that it is one part of a more complicated picture; a sum total of experience representing a well-ordered whole. What the components of such a whole might look like is culturally determined and varies across time and space, although in the Old World at least many seem to revolve around a three-level vertically structured conceptual scheme for the universe. Where the origin of such a scheme lies is unclear, but Kaul (1998) has shown that by the second millennium BC in northern Europe it finds expression as the sky, the earth, and the waters under the earth, each conceived as circular planes that wheel eternally around an *axis mundi*. The gods inhabited all three levels, the living inhabited only the middle plane, while the dead mainly inhabited a fourth dimension closely associated with the watery underworld but accessible through liminal zones and disjunctions at the intersections of sky, earth, and water. Echoes of the basic scheme can be found in contemporary and later Egyptian, Mesopotamian, Greek, Roman, Norse, Celtic, and Abrahamic religions. What is especially important here is that the various elements are bound together by creation myths and narratives that make sense

Fig. 11.1: Spotted dolerite exposed on a horizontal outcrop on Carn Menyn, Preseli Hills, Pembrokeshire, Wales. The area visible in the picture is about 45cm across. [Photograph by Timothy Darvill; Copyright reserved].

of actual and invented experiences and allow real and imagined beings, people, animals, objects, and materials to co-exist and move between planes.

In this way, things seen as part of the skyscape can have agency in the landscape, and vice-versa. A possible example might be present amongst the spotted dolerites used at Stonehenge, Wiltshire, in successive configurations that culminated in the central Bluestone Horseshoe and Outer Bluestone Circle still visible today. Around 60 of these particular stones (part of the overall Bluestone assemblage) were brought more than 225 km from the Preseli Hills of west Wales to Stonehenge around 2500 BC (Darvill 2006, 136–41). At the source outcrops flat horizontal exposures reveal patterns of white spots looking like stars and constellations as if the night sky is mirrored and fixed for ever in the face of the earth (Fig. 11.1). At Stonehenge, blocks of the same stone were set vertically around the inner sanctuary as if lining the precinct with representations of the sky; powerful stones in their own right that I have argued were perceived to have magical healing properties (Darvill 2007). Curiously, dark coloured stone punctuated with white spots was also prized and worked at much the same time at exposures on Lambay Island, Ireland (Cooney 1993; 2002; Darvill 2011) and at Sark in the Channel Islands (B. Cunliffe pers. comm.). All contain large white phenocrysts of quartz and/or feldspar, spots that following deep-rooted traditions along Europe's Atlantic coast could be considered embodiments of the soul (Darvill 2002) or indicators of life-forces within the stone (Reynolds 2009).

On a wider front, the design and construction of many monuments mythologize and dramatize widely understood cosmological schemes. In some cases these might well include the skyscape. Take, for example, the round barrow, one of the most common monuments during the Bronze Age of Europe. At its most simple, a round barrow is just a hemispherical mound of turf, soil, and locally quarried bedrock heaped over one or more graves. But even such simple monuments embody physical expressions of deep-seated beliefs. The visible mound probably represents the domed vault of heaven above the earth, while the deceased is placed in a pit cut into the underworld below. Structurally, many are far more complicated with long histories of construction and use rationalized by additional symbolism, but the main picture is clear. Right across archaeological practice, understanding monuments requires attention to pattern recognition.

Pattern and Purpose

Cosmologies informed the creation of material culture in the past and thus provide the keys to understanding the past in the present. Recognizing patterns without understanding purpose is simply description; statistical probabilities that given monuments tend to focus on the sun or the moon or some recognizable constellation is interesting but ultimately meaningless unless supported by a back-story. When the key works it will unlock all the doors and make explicable the full data set. Patterned behaviour is just that: patterned.

An interesting example of how a seemingly confusing pattern can be resolved is provided by early Christian cemeteries in Britain and other parts of northern Europe. In general, most of the burials in these cemeteries are orientated east-west with the head typically at the west end of the grave. Various explanations for this have been offered (Rahtz 1978, 4), many involving an underlying solar cosmology. By later medieval times the back-story had

formalized as a belief that east-west burial was essential so that on the Day of Judgement, when Christ returns at dawn to claim believers, the dead could sit-up to face the rising sun on the eastern horizon. The principle is simple, and probably reflects earlier practices rather than new Christian dogma; the archaeological evidence is potentially easy to correlate. Indeed, as a rule of thumb any undated east-west burials are generally considered to be Christian. However, in a well-documented case involving the detailed analysis by Philip Rahtz of a large cemetery at Cannington, Somerset, the complexity and diversity of the archaeological record was revealed. Here the orientation of 299 out of the 305 graves for which the position of the body could be determined lay between 49" 72' and 128" 10' east. Locally, with an azimuth range of 78" 38', this represents the Solar Arc between the northernmost sunrise position on the Summer Solstice and southernmost sunrise position on the Winter Solstice (Rahtz 1978, fig 1; and see Brown 1983 for further comment). Although distributed in this way, and at first sight rather unstructured, all in fact conformed to the underlying cosmology because the position of sunrise on the day of the burial determined the alignment of the grave and served to substantiate the associated rituals and ceremonies. What confused the archaeological signature was that the sunrise position along the horizon varied according to the time of year so the cumulative effect of numerous separate events over several centuries created a much more diffuse, but nonetheless reconstructable, pattern.

Sometimes more intimate knowledge is needed to understand how monuments worked in relation to the sky. A case in point is the great temple of Ramses II at Abu Simbel, Nubia, Egypt, cut into the cliffs on the western bank of Lake Nasser. Completed *c*. 1265 BC the temple was dedicated to Amun, Ra-Horakhty, and Ptah. The central axis of the temple was made in such a way that the rays of the sun penetrated the sanctuary to illuminate the sculptures on the back wall (except for the statue of Ptah as the god connected with the Underworld who always remained in the dark) on what in the modern calendar would be 22 October and 22 February. These are not in themselves celestially significance moments, but are believed to be the birthday and coronation day respectively of the pharaoh and thus became significant in the ritual calendar of the time (Fitzgerald 2008). As part of the UNESCO programme to rescue the ancient monuments that would be drowned as a result of constructing the Aswan Dam the temple was relocated in its entirety in 1968 and now lies in an artificial hill high above the waters of the Aswan High Dam Reservoir (Fig. 11.2). Ironically, although the axis of the temple was perpetuated the sun no longer penetrates the inner sanctuary on the days it did in Dynastic times because the altitude of the horizon has changed.

So where does this leave us with reference to more specifically archaeological examples? Silva’s study of megalithic tombs in central Portugal usefully considers ‘windows of visibility’ outwards from the chambers along the passage and, by implication, inwards towards the orthostats forming the back wall of the chamber. The strong correlation with the rising of the star Aldebaran above the *Serra da Estrela* seems convincing and the task now is to understand the role of Aldebaran and its light in the lives of the living and the dead during the later fourth millennium BC. Brady’s review of Old Kingdom pyramid texts also illustrates the widespread belief in the divine nature of stars and the need to take better account of the potential of naked-eye astronomy in seeing these heavenly bodies within the range of sightlines created by architectural form. More speculative is Lomsdalen’s case with the structures at Mnajdra in Malta. Notwithstanding the evident heavy reconstruction work

Fig. 11.2: Façade of the reconstructed temple of Ramses II on the west side of Lake Nasser, Nubia, Egypt. The original temple was completed in c.*1265 BC; in the late 1960s it was cut into pieces and rebuilt on the present site, losing its astronomical significance whereby the rays of the sun shone through the entrance into the sanctuary on what is believed to be the birthday and coronation date of Ramses II: 22 October and 22 February respectively. [Photograph by Timothy Darvill; Copyright reserved].*

at the site, the only set of alignments that look at all convincing are the equinoctial sunrise positions viewed from Room 2 in the so-called South Temple through the eastern entrance. But why might such an orientation be built into the structure of this monument? And why do the axes of other structures at Mnajdra and the score of other contemporary buildings elsewhere on Malta and Gozo have different alignments that seemingly show no interest whatsoever in the Solstitial or Equinoctial sunrise positions? It perhaps illustrates the danger of getting over-excited about solar events that seem important today, or which are exceptional within the range of archaeological sites under consideration, without thinking about the bigger picture as it would have been understood in the past. Seeking and explaining diversity in the patterns and purposes represented in the evidence is as important as finding conformity, if not moreso, and can be seen in approaches to other celebrated classes of monument.

Stonehenge, Wiltshire, is in many senses a unique monument but its primary solstitial axis can be seen at other sites in the area. Woodhenge, for example, 3 km to the northeast also has a solstitial axis rather weakly encoded in the oval architecture of its six concentric rings (Cunnington 1929, 12 and plate 3). But whereas the architecture of Stonehenge suggests a primary focus on the mid-winter sunset, Woodhenge probably focuses on the mid-summer sunrise. In its final phase the two opposed entrances of the earthwork around Durrington Walls open towards the mid-winter sunrise to the southeast and the mid-summer

sunset to the northwest (Parker Pearson 2007, 130; 2012, 79–80). Coneybury, another henge to the east of Stonehenge, appears to be structured around a mid-summer sunrise visible through the northeastern entrance (Richards 1990), and the recently discovered West Amesbury henge beside the River Avon at the terminal of the Stonehenge Avenue probably opens towards the east or northeast as well (Parker Pearson 2012, 225). Right across the ceremonial complex centred on Stonehenge it seems that dimensions of a solar cosmology are embedded in the form and structure of the monumental material culture. It raises the possibility that amongst the deities celebrated here may be forebears of the gods that have come down into more modern times as Apollo and Artemis (Darvill 2008, 144). But not all of the many great ceremonial centres of the later third millennium BC across the British Isles show such solar influences.

Recent work at Thornborough, North Yorkshire, for example, has led Jan Harding to look at quite different parts of the sky (Harding 2013, 205). The cluster of three giant henges, a cursus, and three nearby smaller henges along the east banks of the River Ure allow several key windows of visibility outwards onto the surrounding landscape. Mid-winter sunrise is represented through the southern entrances of the central and southern henges, but more widespread is an interest in the three offset stars of Orion's Belt that on the one hand seem to be reflected in the juxtaposition of the three giant henges on the valley floor and on the other in the visibility of this distinctive and widely recognised formation through the northern entrance of all three giant henges. As Harding remarks: 'Orion's Belt could have been interwoven into the beliefs, practices, and spiritual associations which collectively enlivened the complex and transformed it into a place of special religious poignancy'(2013, 215).

Accepting the possibility that ceremonial centres with similar ensembles of monuments in fact focused on very different structuring principles linked to a variety of cosmological references related to the specific cultural concerns of their builders and users opens up an interesting field of research deserving of further exploration. A modern analogy would be the many and varied dedications assigned to churches and cathedrals across Europe which inevitably leads to the placing of different iconography and a great diversity in the timing and tempo of associated calendar customs, festivals, and celebrations.

Back in prehistory, much the same applies to the developed passage graves of the later fourth and early third millennium BC found in Ireland and along the Atlantic coastlands of Britain (Herity 1974). Here the most celebrated case is Newgrange, Co Meath, Ireland, with its very clear architecturally embedded interest in the mid-winter sunrise that here creates a beam of light that illuminates the passage and the orthostat at the back of the central chamber (O'Kelly 1982, 124). Solstitial alignments are present at other developed passage graves, although the details vary: mid-winter sunset is encoded at Maes Howe, Orkney (McKie 1988); mid-summer sunrise at Bryn Celli Ddu, Anglesey (Burrow 2010); and sunrise on the equinoxes at Le Hougue Bie, Jersey, on the Channel Islands (Patton *et al*. 1999, 120). Slightly more complicated is Knowth, Co Meath, Ireland, just 2 km west of Newgrange and also within the Brugh na Bóinne ceremonial complex. Here, one chamber opens to the east and would be illuminated at sunrise around the time of the equinoxes while a second opening to the west would be illuminated at sunset on the same days in March and September (Eogan 1986, 178). But these are just a handful of examples amongst scores of similar monuments great and small that relate to a variety of contemporary cultural traditions across the British Isles. Most are orientated so that the sun will penetrate the chamber during sunrise or sunset

for a few days each year, but not at what are nowadays recognized as key moments such as solstices and equinoxes. The absence of a single obvious pattern to the orientation and alignment of these monuments again suggests that we need to look deeper for the key. With the example of Ramses II in mind it may be that passage graves celebrate critical moments in the lives of their founders or perhaps they refer to conditions at the time of locally relevant festivals that across the whole population of such sites would be well distributed through the year. Some might fall on the solstices and equinoxes, but for other communities the significant days lay elsewhere in the calendar. Perhaps, like the early Christian burials discussed above, the pattern simply reflects the sunrise or sunset position on the day the monument was set out. Or, alternatively, the application of innovative methodologies, such as Silva's 'window of visibility' approach, will reveal new and unsuspected patterns of a different nature.

Time-depth and Continuity

Many of the case studies unfolded in the chapters of this book remind us of the longevity of traditions that involve skyscapes and that reference events in the heavens. Closer dating of archaeological features and the extensive investigation of sites through modern approaches to excavation have expanded the picture still further. It is increasingly clear that in many parts of the Old World the appearance of the first monuments can no longer be associated with early farming communities. From Göbekli Tepe in eastern Turkey (Dietrich *et al.* 2012), to the stone menhirs of western France (Le Roux 2008), and the timber totems in the Stonehenge landscape of central southern Britain (Darvill 2006, 62–3) it is clear that hunter-gatherer communities made monuments too, and these most likely embrace and reflect prevailing cosmologies. Vince Gaffney and colleagues have suggested that the monumental alignment of 12 possible post-sockets set within larger pits at Warren Field near Crathes in Aberdeenshire, Scotland, first constructed *c*. 7800 BC and recut *c*. 4000 BC may be a calendrical structure of some kind using the local hills as a fore-sight (Murray *et al*. 2009; Gaffney *et al*. 2013). As Sims shows in his contribution to this book, features created in one phase can influence the development of later structures and this chronological/stratigraphic depth needs to be taken into account when defining patterns in the data. Continuity and change will be a major theme of skyscape archaeology in future and no doubt come to play a key part in understanding shifting cultural and religious attitudes.

It is not always necessary to look to the sky itself to understand the cosmologies and narratives derived from or related to skyscapes. Oral histories, traditions, folklore, and the anthropology of contemporary societies can be very relevant, and are well illustrated by the insights offered in several chapters here. Prendergast, for example, draws heavily on cross-cultural analogies to explore later prehistoric occupation sites in Ireland while Pritchard connects the apparent concern for the motion of the stars Vega and Deneb embedded in the outlook from the King's Quoit with swan imagery and transcriptions of the Welsh for swan (yn alarch) reflected in the recorded placename of Norchard. And Silva uses ideas of seasonal movements across the landscape transposed from modern transhumance practices in the *Serra da Estrela* to add meaning to the focus on Aldebaran for the living and the dead detected in the megalithic tombs of the area. All of these move the interpretative focus into new arenas by opening up possibilities for investigation.

Conclusion

The potential of bringing skyscapes centre-stage in archaeological thinking is considerable, and will add new textures, tastes, and sounds to reconstructions of the past. Problems of course remain, and several authors in this volume have struggled to overcome obvious limitations in their source datasets. Among the most intractable difficulties are the well-known hurdles of dealing with partial data, heavily damaged sites, inaccurate surveys, poor reconstructions, understanding the capabilities of technologies available to ancient cultures, and a poor or non-existent knowledge of the physical environment to inform questions of visibility and intervisibility. Some of these can be overcome through patient research and by focusing on sites and places for which high quality data survives and where observations can be replicated. There is also much to do in terms of scoping the dimensions of lived-in experiences of the world that the study of skyscapes could contribute to. This includes thinking about the cycles and frequency of skyscape-events. Short-term phenomena such as weather, cloud patterns, darkness, brightness, thunder, lightning, rainbows, swarms of flying insects, flocks of migratory birds, shooting stars, and colour rendering of the terrestrial environment are often unpredictable poignant and sometimes threatening experiences. Equally unpredictable in the ancient world, but of longer duration and impact, were visitations by comets, asteroid showers, and dust clouds. More predictable, fixed, and long-term are the risings, settings, and movements of the sun, moon, and stars. In much folklore it is the Milky Way that features strongly in creation myths and cosmological narratives, but perhaps because it is not so easily recognizable under light-polluted modern skies it rarely features in archaeological discussions and is another dimension that deserves further investigation. Whether in relation to the structuring of daily or seasonal routines, geomantic guidance for the location and position of special places, divination and prediction, or simply the evidential base underpinning mythical narratives and cosmologies the sky was an important domain that archaeology needs to understand better.

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